

# PIX

12 - 17 - 24 kV

with SF<sub>6</sub> gas switchgear

## Installation Operation Maintenance Technical Instructions

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**Schneider Electric**

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# 1 Schneider Electric at your service

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Electrical equipment requires especial attention and the compliance with the provisions stipulated in this manual. Operating procedures and maintenance work must be performed by qualified staff who are adequately skilled for their tasks. Your local Schneider Electric Service will be at your disposal at any time for support and advice.

Reminder: The mechanical lock-outs must be designed according to the general safety provisions for electrical equipment and the specific provisions for the network in question.

## 1.1 Your contacts

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## 2 With regards to this user manual

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This brochure applies to single busbar single-stage functional units 12 - 17.5 - 24 kV.

### 2.1 Warranty

Our equipment is subjected to factory inspection and testing according to the applicable standards and provisions.

The correct function and the service life of the switchgear are influenced greatly by compliance with the installation, commissioning and operating conditions stipulated in this manual. Non-compliance with these provisions may compromise warranty claims.

Any local provision which does not contradict the specifications of this document, especially as regards safety for personnel and buildings, must be complied with.

Schneider Electric cannot be held liable for the possible consequences of:

- non-compliance with the provisions contained in this manual, which refer to international regulations
- non-compliance with the instructions of the suppliers of cables and connecting accessories as regards application and installation
- any aggressive climate conditions (humidity, pollution etc.) prevailing in the immediate environment of switchgear not suitable to this effect or not protected accordingly.

This manual does not contain any instructions regarding the mechanical lock-outs to be performed. The work described is performed on de-energized (on installation) or mechanically locked-out (decommissioned) switchgear.

### 2.2 Eco-friendly design and utilization of the materials used

The design and execution of our packaging materials corresponds (in France) to the decree n° 98-638 dated 20 July 1998 as regards environmental compatibility.

### 2.3 Normal operating conditions (as provided by standard IEC 60694)

#### Admissible ambient temperature

The ambient temperature must be in the range from -5°C and +40°C. The average value measured over a period of 24 hours must not exceed 35°C.

#### Installation altitude

High-voltage switchgear has been designed according to the appropriate European standards and can be installed up to an altitude of 1000 m. At higher installation altitudes, the reduced voltage endurance must be taken into account.

In special cases, please contact the Schneider Electric Sales Department.

#### Air pollution

The ambient air must be free of dust, smoke, corrosive or combustible gases, steam and salt.

#### Admissible air humidity

The average air humidity measured over a period of 24 hours must not exceed 95%. The average vapour pressure, measured over a period of 24 hours, must not exceed 22 mbar.

The average air humidity measured over a period of one month, must not exceed 90%.

### 2.4 Tough climate conditions

In an environment subject to frequent and sudden temperature changes, condensation may occur after excessive ventilation, increased air humidity or in the presence of warm air.

## 2 With regards to this user manual (contd.)

Such condensation can be avoided by suitable arrangement of the room or the building (appropriate ventilation, air driers, heating etc.).




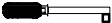






In this case, the switchboard must be installed in a temperature-regulated room (20°C).

Please consult Schneider Electric concerning any precautions or specifications for the relevant situation.

### 2.5 Other technical manuals which may be consulted

AMTNoT023	General lubrication instructions	
AMTNoT014	Gyrofluor GFA Contactor SF <sub>6</sub>	Installation - Commissioning - Operation - Maintenance
AGS 531360-01	UTX & MTX	Installation and operating instructions
AMTNoT026	ORTHOFLUOR FPX Circuit breaker	Installation - Commissioning - Operation - Maintenance
AMTNoT027	BRH Mechanical control mechanism	Installation - Commissioning - Operation - Maintenance
AMTNoT053	DCX	Presentation - Commissioning - Operation
AMTNoT054	DCX	Parameter setting by PC Instructions Manual
AMTNoT069	DCX	Modbus Communication
AMTNoT077	PIX	Additional equipment
AMTNoT083	Specific drawing units	Test drawing unit

### 2.6 Tools and maintenance products (not supplied) necessary for operations described in this instruction manual

■ Cutter	
■ Crow bar	
■ Open-ended spanners size 8 ; 13 ; 16 ; 18	
■ Ratchet wrench with socket sizes 8 ; 13 ; 16 ; 18	
■ Allen keys for hexagonal screws size 8 ; 10 ; 12	
■ Torque wrench with sockets size 13 ; 16 ; 18 and sockets for hexagonal screws size 12	
■ Flat blade screwdriver	
■ Torx 25 screwdriver	
■ Cutting pliers	
■ 4 slings (capacity 1,000kg)	
	Product code
■ Clean dry cloth	-
■ Solvent (dielectric withstand >30kV), excluding any chlorinated solvents	-
■ Mobilplex 47, Mobilux EP3 from Mobil or Stabilube T6 from Sophos mechanical grease	
■ Grease for electrical contacts Electrolube 2GX from Comindus	



## 2 With regards to this user manual (contd.)

### 2.7 Special instructions for operations and any intervention with energized equipment

When commissioning and operating switchgear equipment under normal conditions, the general electrical safety instructions (gloves, insulating stool, etc.), as well as operation handling instructions should be respected. All manipulations must be completed once started.

The lengths of time required for carrying out the operations mentioned in the tables are given purely as an indication and depend upon conditions on-site.

### 2.8 Conventional symbols



Code of a product recommended and marketed by Schneider Electric



Value of the tightening torque  
Example: 16 N.m



Mark corresponding to a legend



CAUTION! Remain vigilant! Precautions to be taken in order to avoid any accident or injury.



FORBIDDEN! Do not do it! The compliance with this indication is compulsory, non-compliance with this stipulation may damage the equipment.



INFORMATION - ADVICE Your attention is drawn to a specific point for installation or operation.

### 2.9 Tightening torques for standard assemblies (bolt + nut)

Threaded fasteners without grease: assembly with ungreased washers.  
Threaded fasteners with grease: assembly with greased washers.  
Use grease referenced



Dimensions	Ungreased zinc-plated steel threaded fasteners (N.m)		Greased stainless steel fasteners (N.m)
	Class 6.8	Class 8.8	A2-70
M 6	7	9	7
M 8	16	21	16
M 10	32	43	32
M 12	50	66	50
M 14	87	116	87
M 16	134	179	134
M 20	262	350	262

## 3 Presentation

### 3.1 Description

The PIX metal clad switchboard was designed so that all of the elements are accessible from the front facing panel.

The functional unit is divided into 4 compartments: cables, moving part, busbar and low voltage switchboard.

They are separated by metal partitions. The cable compartments, moving part and busbar are all equipped with gas exhaust valves in case of any internal arcing.

### 3.2 Space requirement and approximate weight of the PIX 12 kV, "Incoming-Outgoing", without packaging

Width of the functional units (mm)	650	800	1000
Depth (mm)	1405 <sup>1)</sup>	1405 <sup>2)</sup>	1405 <sup>2)</sup>
Height depending on the low voltage box (mm)	2130-2230-2330	2130-2230-2330	2130-2230-2330
Approximate weights (kg) with circuit breaker	720	770	820
Approximate weight (kg) without circuit breaker	600	650	700
Approximate weight (kg) with contactor	700	-	-

<sup>1)</sup> 1605 (case for 40 kA internal arcing or 2 CT per phase)

<sup>2)</sup> 1605 (case of 2 CT per phase)

### 3.3 Space requirement and approximate weight of the PIX 17 and 24 kV "Incoming-Outgoing", without packaging

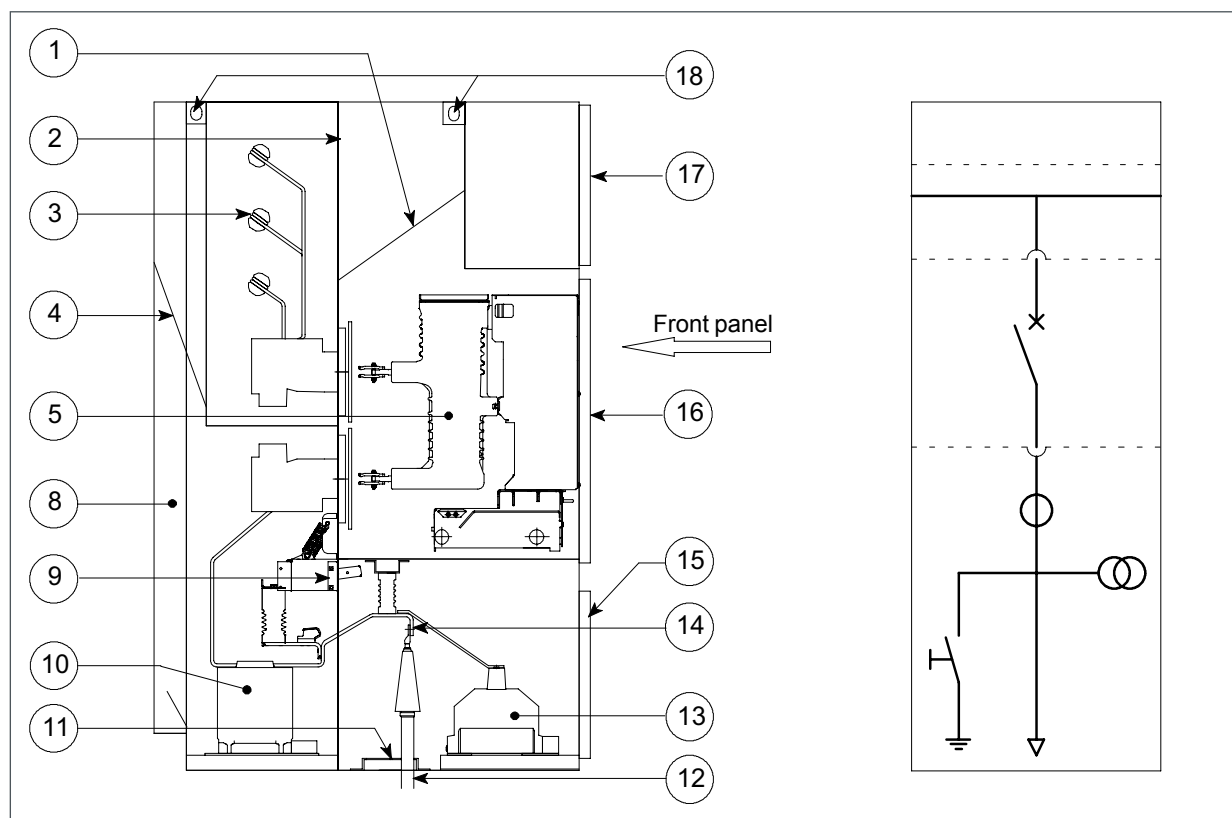
Width of the functional units (mm)	800	1000
Depth (mm)	1605	1605
Height depending on the low voltage box (mm)	2330-2430-2530	2330-2430-2530
Approximate weight (kg) without circuit breaker	620	650
Approximate weights (kg) with circuit breaker	820	870

### 3.4 Designations of the moving parts

Circuit breaker	FPX
Contactor	GFX
Bus-trunk	UTX
Voltage transformers on the busbars	MTX
Test drawing unit	-
Drawing unit - visual inspection	-

### 3.5 Presentation of the functional units

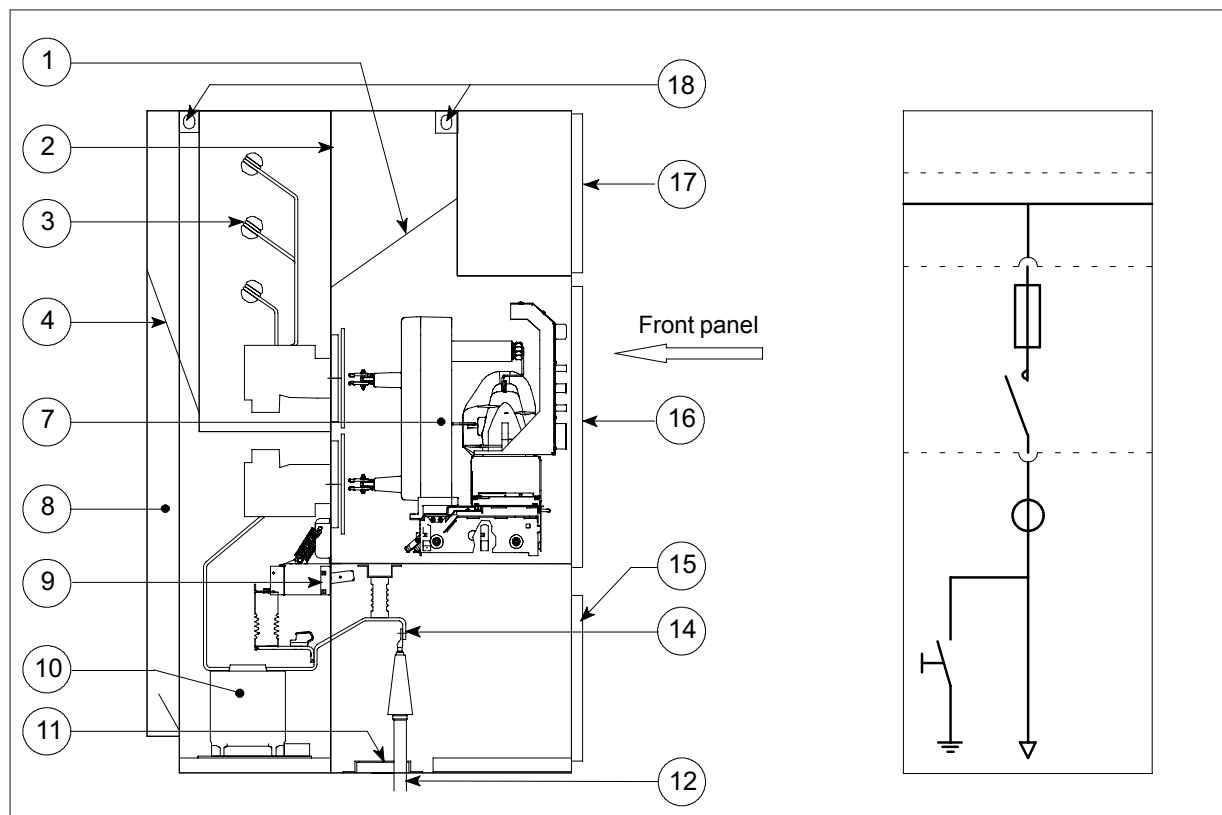
#### "Incoming - Outgoing" feeder functional unit



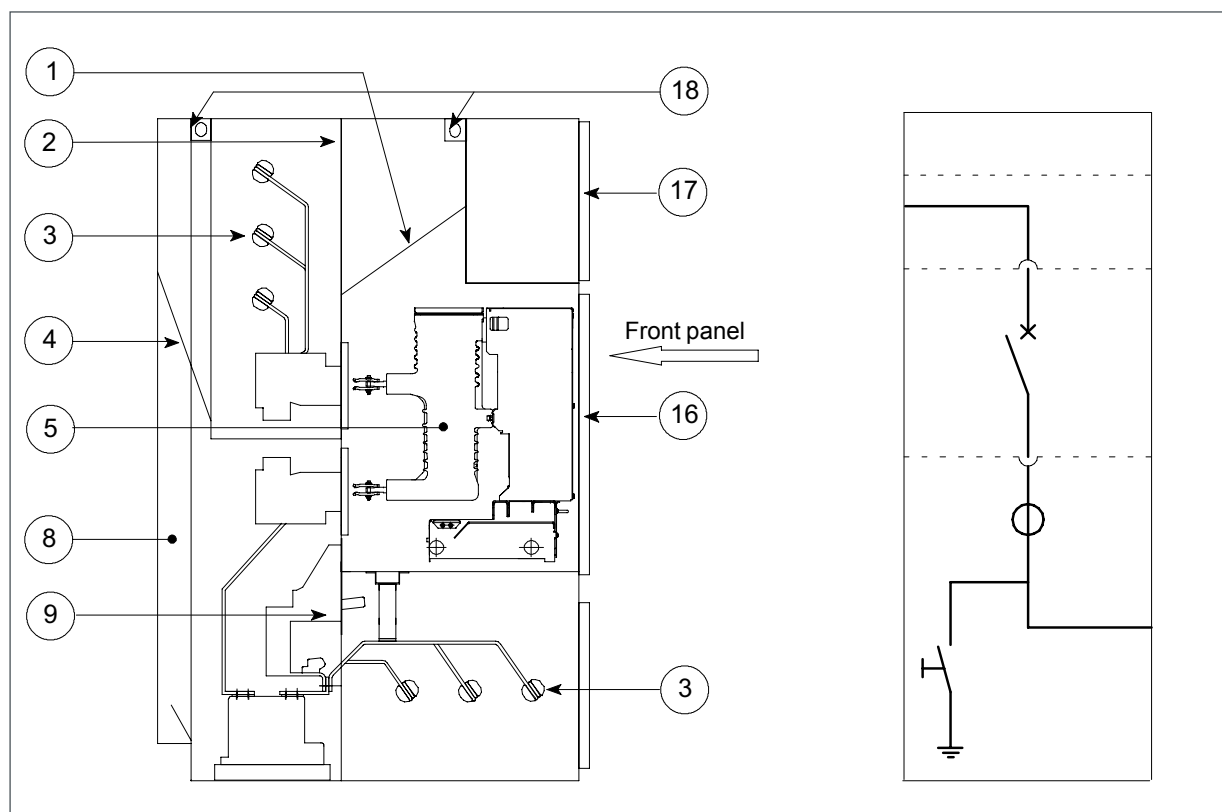
#### Legend

- 1 Internal arcing valve for the moving part compartment
- 2 Internal arcing valve for the busbar compartment
- 3 Busbars
- 4 Internal arcing valve for the cables compartment (or vbusbars)
- 5 Orthofluor FPX Circuit breaker
- 6 MTX "Voltage transformers" moving part
- 7 GFX Contactor
- 8 Gas exhaust duct
- 9 Earthing switch
- 10 Current transformers
- 11 Cable clamping metal sheets
- 12 Medium voltage cables
- 13 Voltage transformers
- 14 Cable connection lugs
- 15 Access panel to the cable compartment
- 16 Access door to the moving part compartment
- 17 Access door to the command control box
- 18 Fixed points for slinging

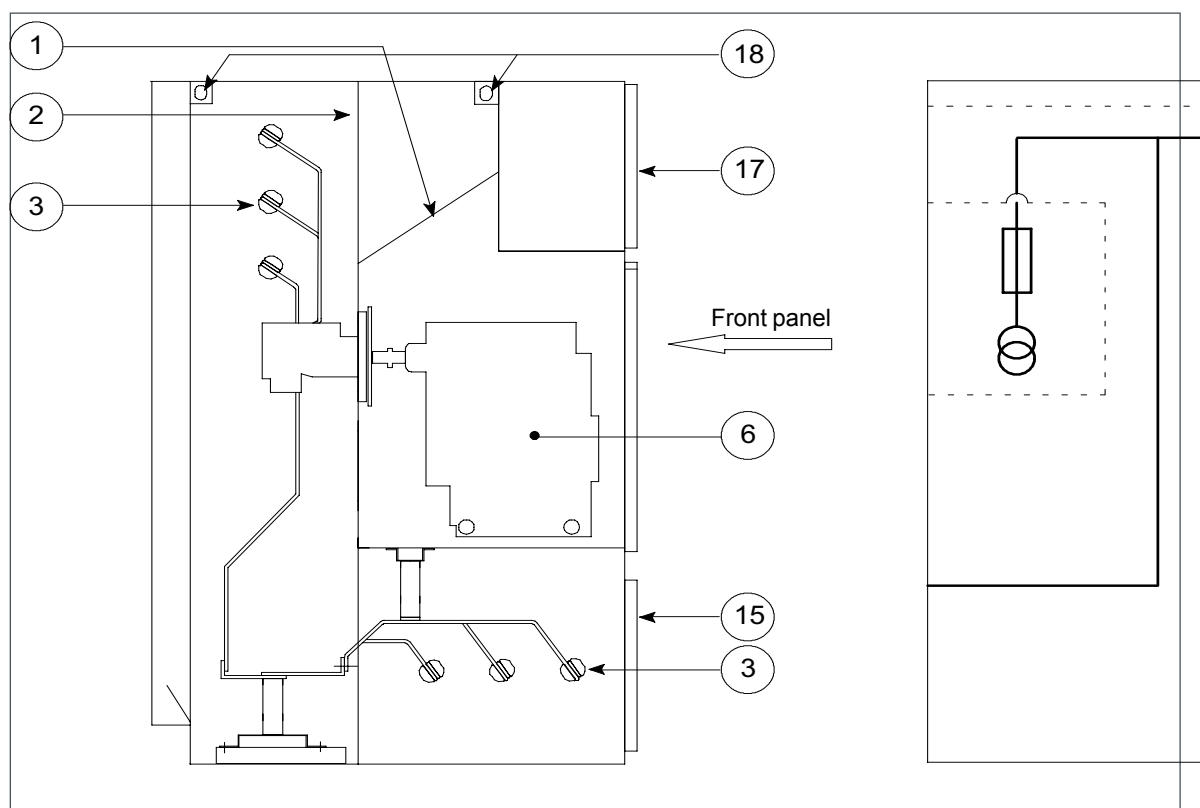
## "Motor Outgoing" functional unit (only in 12 kV)



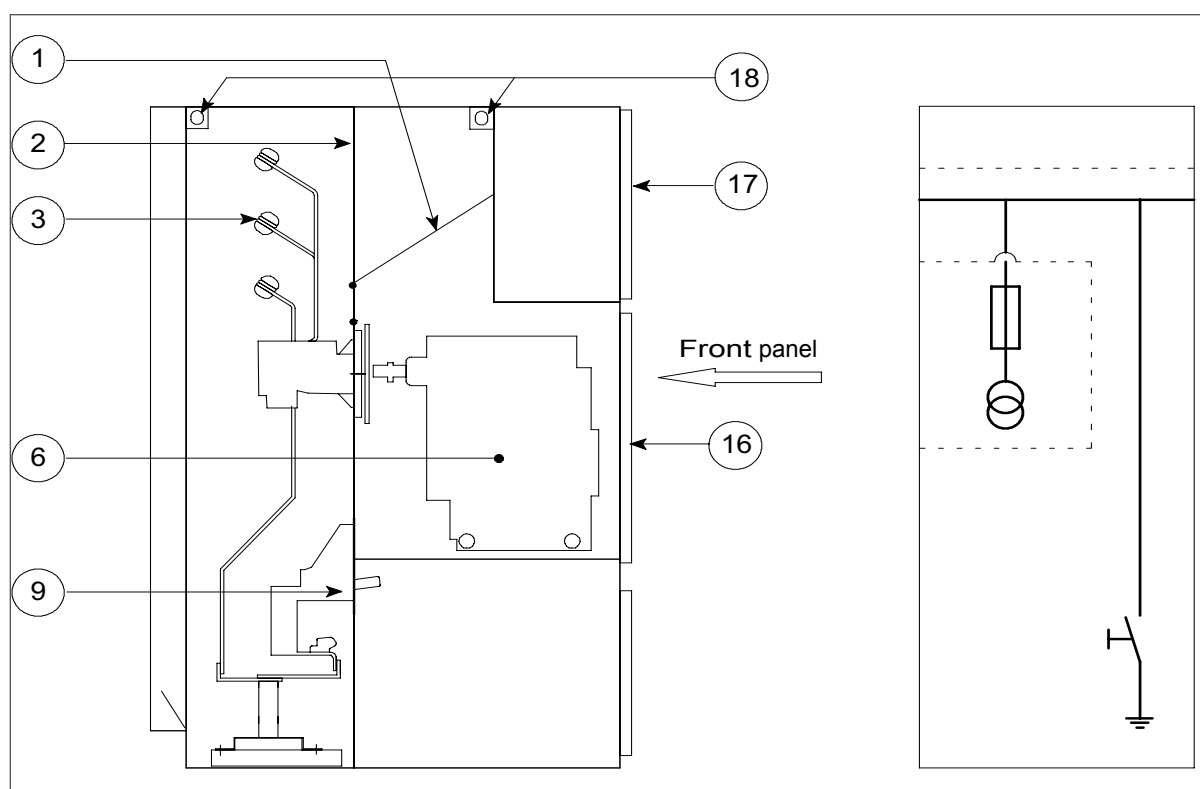
## "Coupling" functional unit with earthing switch



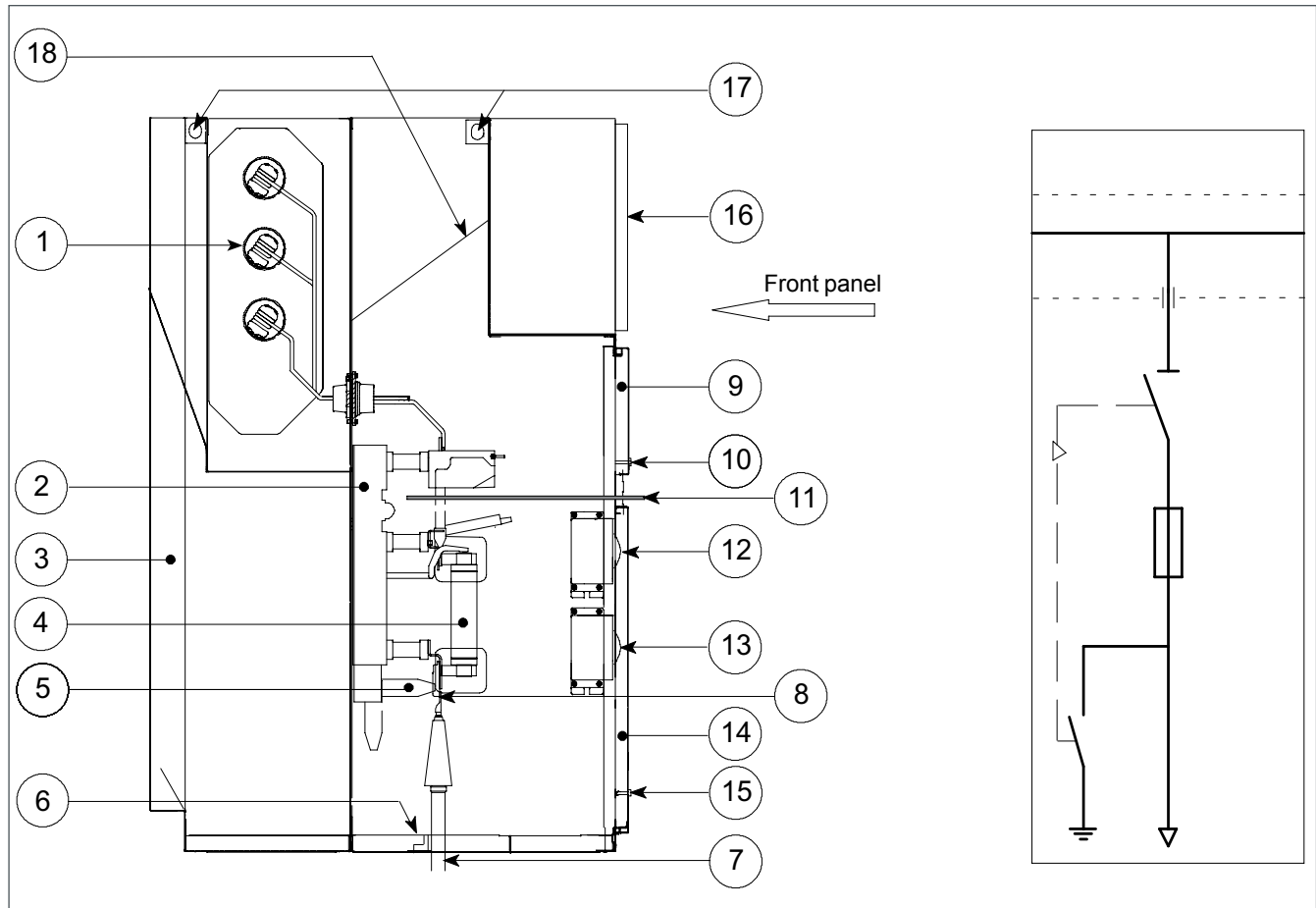
#### "Bus-risers with withdrawable voltage transformers" functional unit



#### "Voltage measurement on busbars with withdrawable voltage transformers" functional units



## 3.6 Presentation of the L-TRI functional unit



### Legend

- 1 Busbars
- 2 L-TRI switch
- 3 Gas exhaust duct
- 4 HV fuses
- 5 Earthing switch
- 6 Cable clamping metal sheets
- 7 Medium voltage cables
- 8 Cable connection lugs
- 9 Access panel to the busbar compartment
- 10 Panel fixing screws
- 11 Insulating plate (red)
- 12 Switch drive disk
- 13 Earthing switch drive disk
- 14 Access panel to the cable compartment
- 15 Door fixing screw
- 16 Access door to the command control box
- 17 Fixed points for slinging
- 18 Internal arcing valve for the moving part compartment

## 4 Packaging - Handling - Storage

### 4.1 Transport - Delivery

The conditions and methods of transport are defined with the customer, at the time of processing the contract. The packaging depends on the transport conditions, storage and the nature of the product transported.



Functional units with a width of 1000 mm and their moving parts are delivered vertically, in separate packaging.

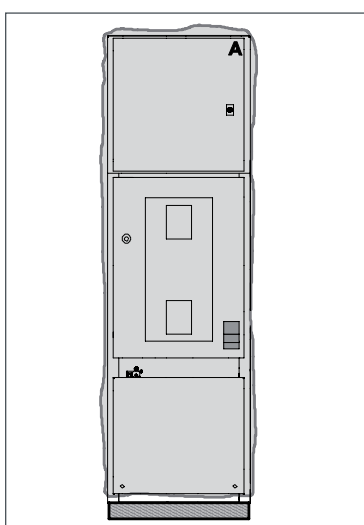


Functional units with a width of 650, 750 and 800 mm can be delivered vertically, with their moving part in the "withdrawn/test" position, strapped to the inside of their compartment.

### 4.2 Packaging of the functional units

- Packing the panel for truck and train transport:

- ☐ fastened to wooden bars,
- ☐ protected by a hood,
- ☐ front protected with foam material.

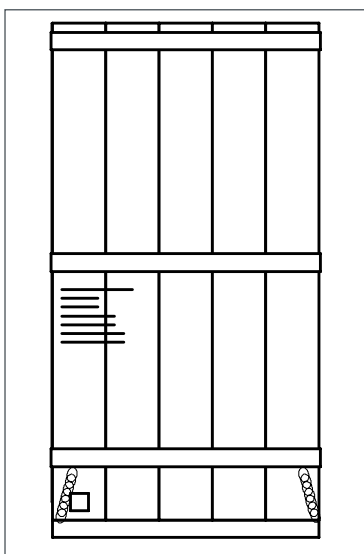


- Packing the panel for air and sea transport:

- ☐ using shrink-wrap and desiccant bags,
- ☐ packed in a wooden crate.

- State of the equipment on delivery:

- ☐ earthing switch „closed“,
- ☐ circuit breaker „strapped“ and „opened“, and „withdrawn/test“,
- ☐ mechanical control mechanism „disarmed“.



### 4.3 Packaging and handling of the FPX moving part

For the lay-out in the packaging and handling of the circuit breaker, please refer to instruction manual AMTNoT026 "ORTHOFLUOR FPX Circuit breaker"

For all shipments by air, the SF<sub>6</sub> gas pressure is lowered to 0.5 relative bar. A refilling and pressure adjustment kit is delivered with the device.



In cases where the switchgear travels under reduced pressure, pump the circuit breaker back to nominal pressure before any closing or tripping operation.

## 4 Packaging - Handling - Storage (contd.)

### 4.4 Drawing unit accessories

Contains the elements required for installation and connection of the switchgear panels to the busbars and cables.

### 4.5 Reception/Acceptance

- Ensure that the materials delivered is complete (list enclosed with the accessories).
- Carry out a visual inspection of the functional units and moving parts.



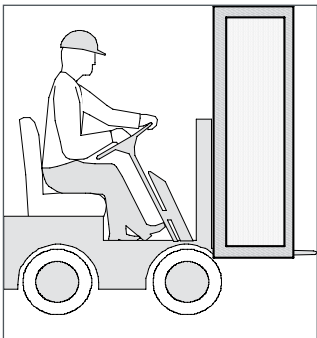
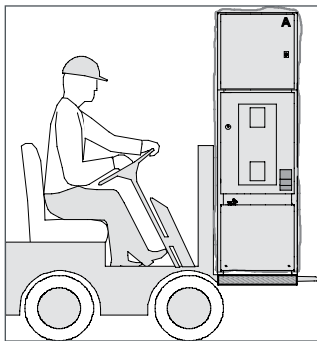
In the event of an anomaly, make the necessary reserves with the carrier.



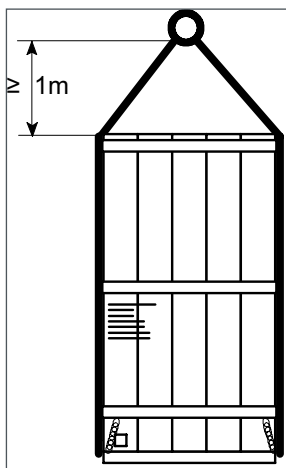
The functional unit must remain vertical on its base, within its original packaging, during any eventual storage period and until it arrives at the location of its installation.

### 4.6 Handling of the functional unit and the moving part

- Truck and train transport (max. 900 kg): by means of forklift truck.
- It is imperative to ensure that the forks of the truck are fully engaged throughout the entire width of the functional unit.



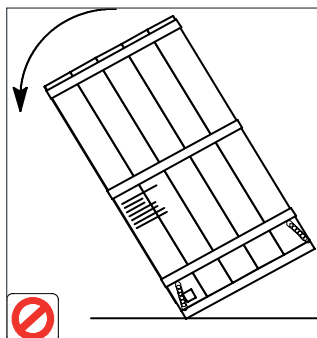
- Packaging for air and sea transport: depending on the weight indicated on the crate.
- It is imperative that the forks of the truck are fully engaged throughout the entire width of the crate.



- Pass 2 slings, supporting 1000 kg each under the crate on both sides of the cross-bars.
- The weights of the crates are indicated on their sides.



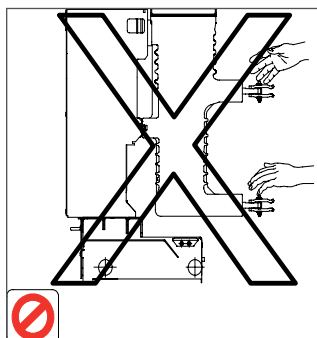
## 4 Packaging - Handling - Storage (contd.)



- Never tip the crates over.



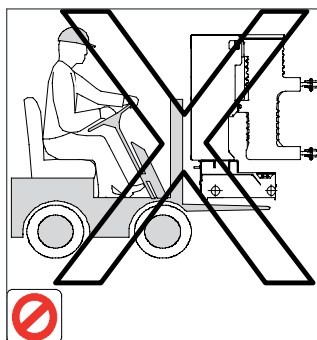
In order to lift or deposit the moving part on the handling table, make allowance for a jib crane (not supplied).



- Never handle the circuit breaker by its connecting plates.



The moving parts do not roll on the ground



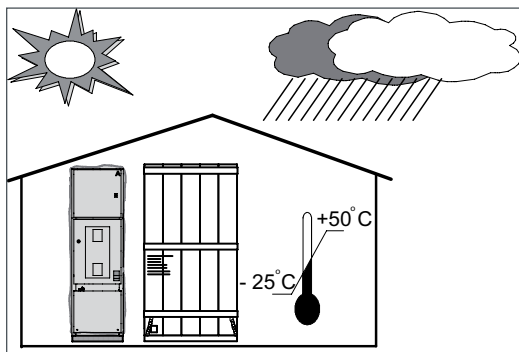
- Never lift up a circuit breaker by lifting it under its chassis or under its trolley.

### 4.7 Storage

The storage area must protect the equipment against any eventual degradation agents, such as:

- water
- water vapour
- saline atmosphere
- pollution of all kinds
- micro-organisms.

Please consult Schneider Electric for any derogations to these criteria.



Ensure that the equipment has really been packaged in accordance with the demands of the forecasted storage period.

Avoid warehousing the equipment in premises that are subjected to important and sharp temperature differences.

Ensure the total absence of aggressive vapours, sulphur dioxide (SO<sub>2</sub>) for instance.

## 4 Packaging - Handling - Storage (contd.)

### 4.8 Intervention levels

Definition	Levels
Operations ensured by the Customer	1
Operations necessitating training, to be carried out by an approved third party	2
Work to be carried out only by Schneider Electric	3

### 4.9 Specific instructions for storage of less than 6 months

Packaging under plastic covers	1	2	3
Inspect the packaging periodically	■	■	■
When unpacking: - Check the mechanical operation by carrying out about several operations*	■	■	■

### 4.10 Special instructions for storage from 6 to 12 months

Packaging under heat-sealable linen, with the presence of bags of desiccant	1	2	3
Inspect the packaging periodically (absence of perforation amongst others)	■	■	■
When unpacking: ■ Check the mechanical operation by carrying out about several operations *	-	■	■
■ Test the min. threshold level (AC, 85% rated Un; DC, 70% of Un) for electrical operation of the coils	-	■	■

### 4.11 Special instructions for storage from 12 to 24 months

Packaging under heat-sealable linen, with inspection hatch to change the bags of desiccant	1	2	3
Inspect the packaging periodically (absence of perforation amongst others)	■	■	■
Periodically replace the bags of desiccant	■	■	■
When unpacking: ■ light maintenance work	-	-	■
■ Check the mechanical operation by carrying out about ten operations*	-	-	■
■ Test the min. threshold level (AC, 85% rated Un; DC, 70% of Un) for electrical operation of the coils	-	-	■



\* Following air transport, the pressure of a SF6 circuit-breaker must be restored to its nominal value before any mechanical functional test.

## 5 Unpacking and installation of the equipment

### 5.1 Type of Building Structural Work

The installation of a switchboard requires a sufficiently flat and even concrete structure. The dressing of a top coat finish of cement with a straight edge should eliminate any surface irregularities and declivities of greater than 2mm per metre. A lay-out seated on levelled metal supports is ideal, as they will also serve as a guide for the dressing of the cement topcoat.

The overall flatness of the support surface should not show up any deflection greater than 6 mm throughout the length of the switchboard.

### 5.2 Unpacking functional units

Unpacking the functional units should only take place on the installation site.	Tools required: ■ Cutter for road and rail transport packaging ■ Crow bar for air and sea packaging.	For all handling operations it is advisable that you use suitable protective gloves.
To remove the stringers, dismantle the "cables" compartment panel.	Dispose of the packaging waste (wood, polystyrene) via the appropriate recycling channels.	Before handling a far end functional unit, remove its far end side panel.



### 5.3 Identification of the functional unit

Check the technical characteristics shown on the nameplate, in comparison with the initial order.

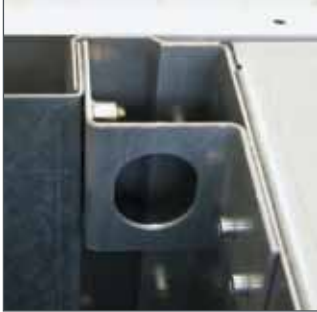
Information taken from this plate is necessary for any contact with Schneider Electric.

Other identifications may be given, in accordance with the particular specifications on the contracts.

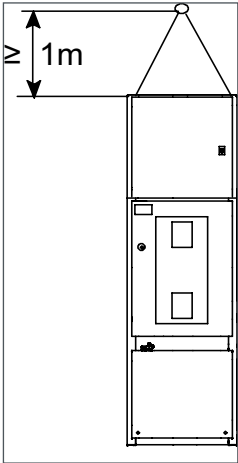
## 5 Unpacking and installation of the equipment (contd.)

### 5.4 Handling the functional unit (always in vertical position)

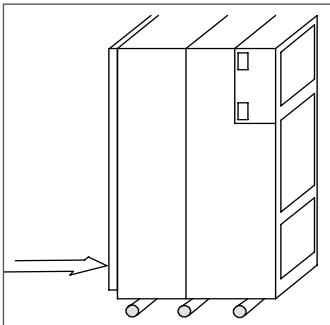
- Four fixed slinging points are provided for on the roof of each functional unit.



- Lift the functional unit by 4 slings
  - each one capable of supporting 1000 kg.
- Respect the minimum height as shown on the left diagram.



- Slide the functional unit along, using three cylindrical rollers of 30 mm min. diameter.
- Thus moving it to its final installation point.

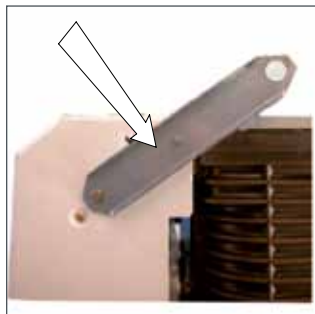


### 5.5 Handling the moving part for placing it on the ground

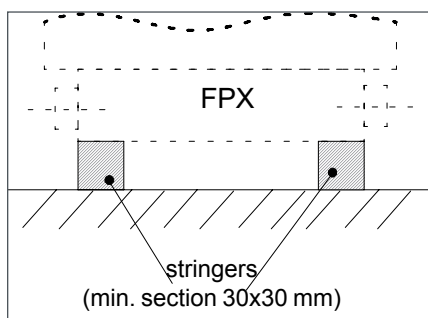
- Moving part < 2000 A: hook up the 2 slings in the holes in the upper part of the chassis.



## 5 Unpacking and installation of the equipment (contd.)



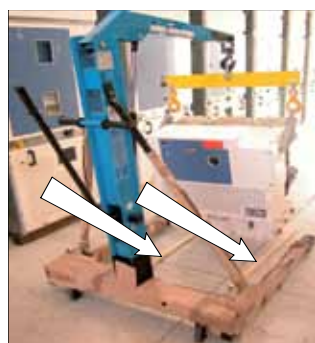
- Moving part  $\geq 2000$  A: install the 2 slinging lugs (delivered with the moving part).



- On the ground, prepare 2 stringers that will be aligned with the outer edges of the truck.



- Hook up the lifting beam and very slowly lift the moving part.



- The moving part does not roll along the ground. It must be placed on the 2 stringers.



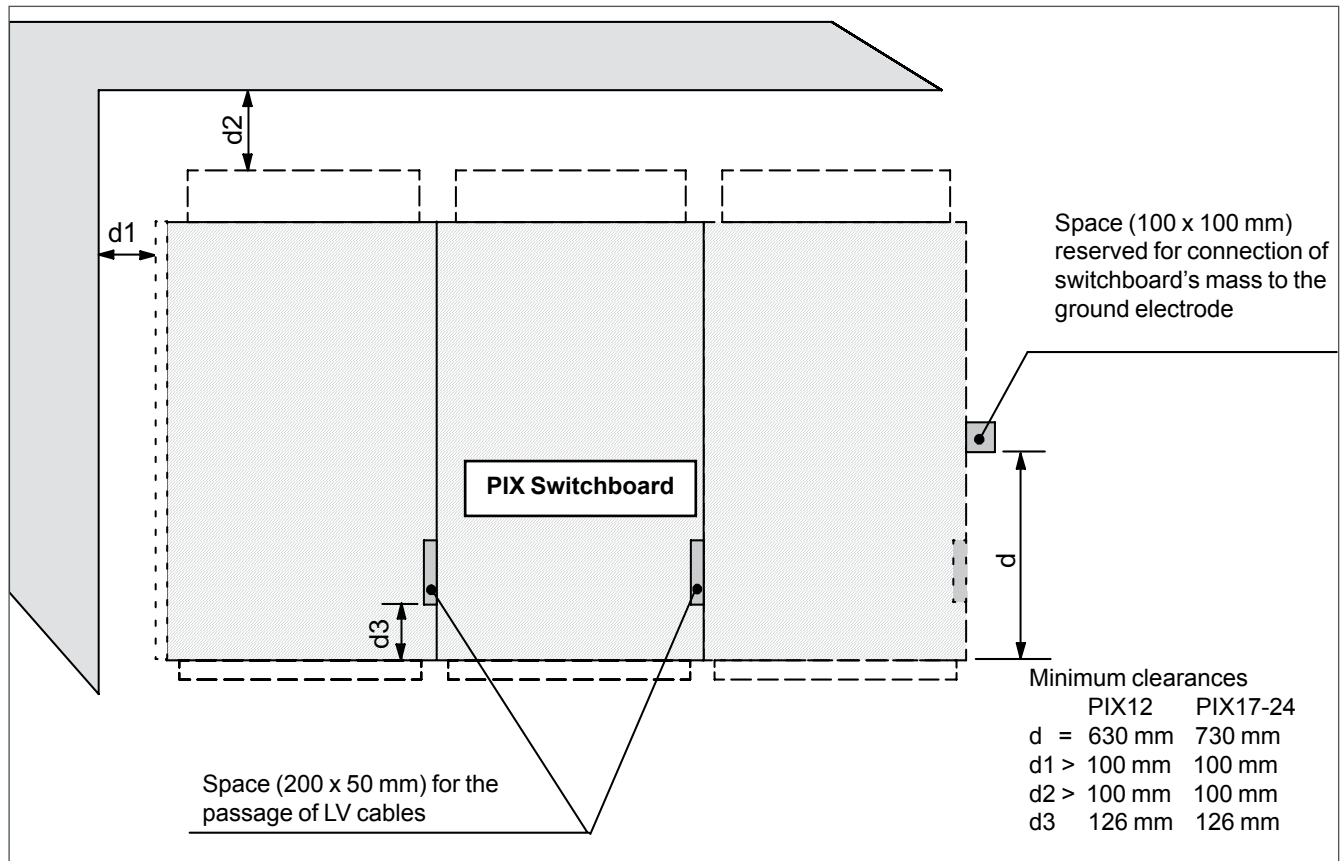
- Place the moving part on the ground, on top of the stringers.

## 5 Unpacking and installation of the equipment (contd.)

### 5.6 Installation on the ground

The limits of the structural civil engineering layout depend on the type and quantity of equipment to be installed. Position the functional units whilst respecting minimum clearance distances in front of, behind and to each side of the switchboard.

### 5.7 Installation of a back-to-wall switchboard (top view)



## 6.1 Installation of functional units

For a switchboard composed of 1 to 8 functional units, it is recommended to begin installation of the equipment on the side opposite the access to the premises.

For a switchboard with more than 8 units, begin the installation of the equipment by the middle of the switchboard.

## 6.2 Fitting each of the functional units in place



Suitable gloves must be worn during installation work.

The switching panels' incoming feeders must be arranged according to the schematic diagram.

Each incoming feeder must be routed exactly perpendicular to the floor. Align the fronts.

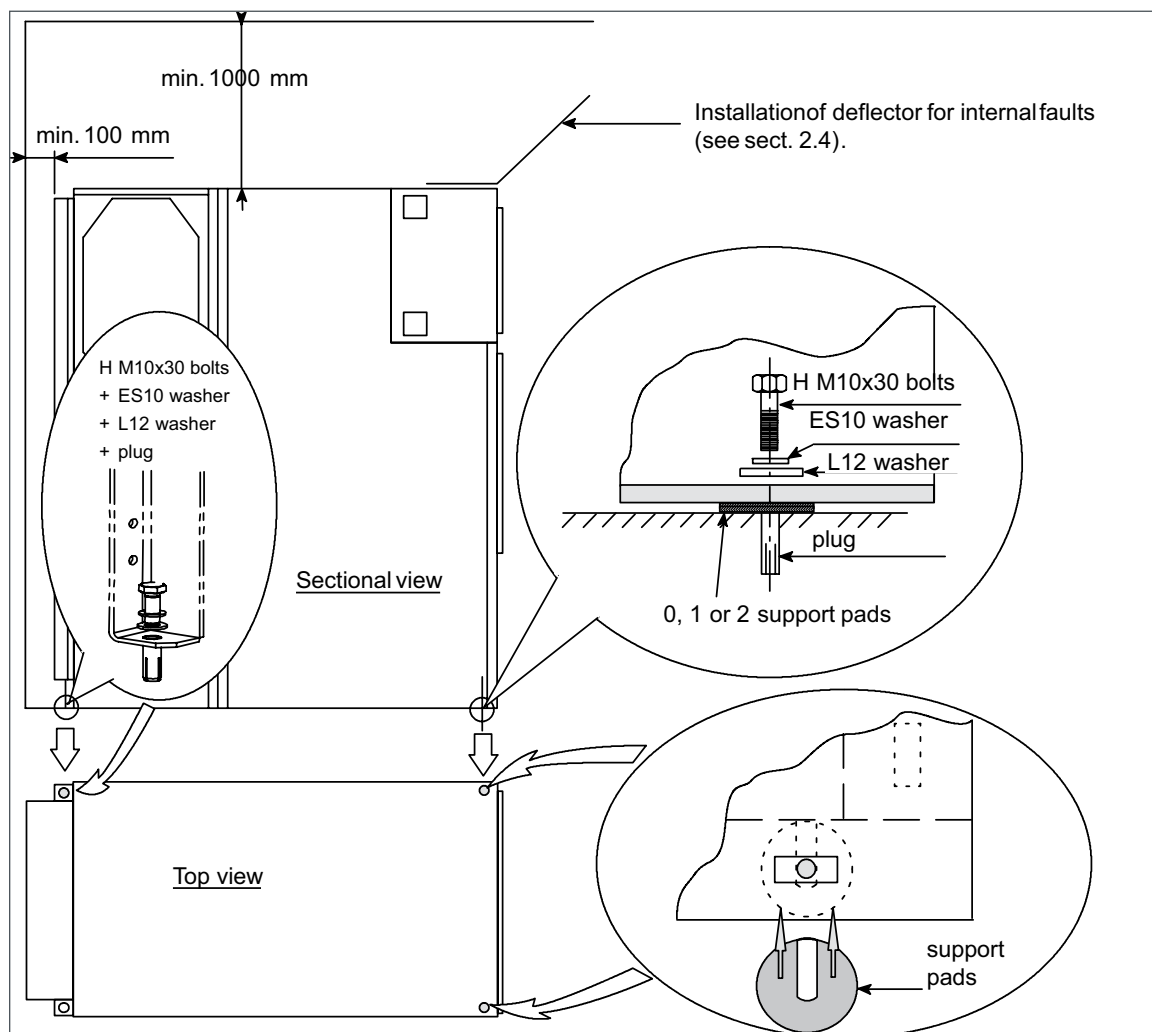
Align further switchgear panels conducting the same verifications.

Anchor panels to the ground by three-point fastening.

■ 2 in the lower cross-beams on the front (hex. bolt M10x30 + dowel pin),

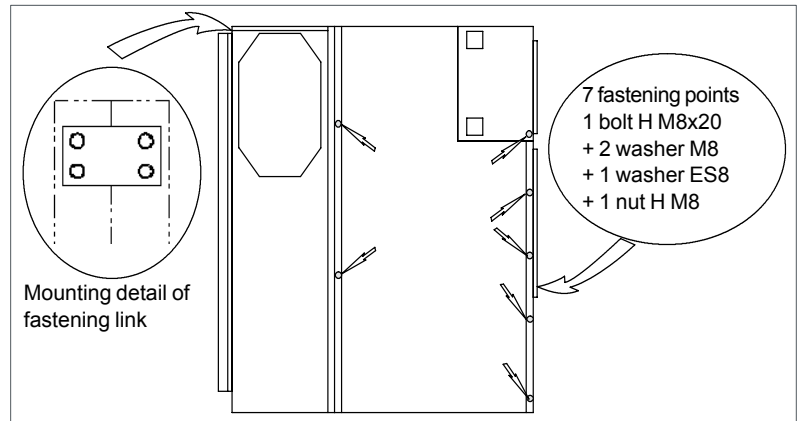
■ 1 at the outer rear side of the panel.

If necessary, block using the bases supplied with the equipment.



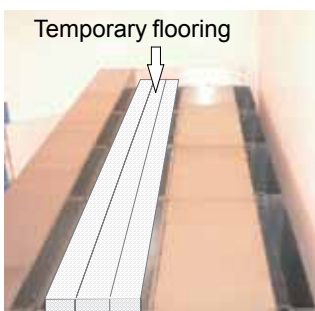
## 6.3 Connecting the panels

Connect panels to 7 securing points (hex. bolts M8x20).  
Interconnect panels on the top rear using fastening links (4 hex. bolts M8x20).

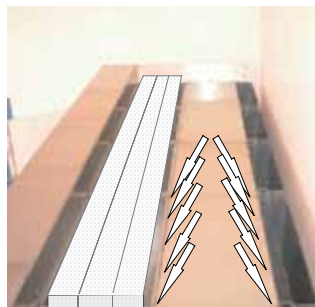


## 6.4 Preparation of the Busbar connection: access by the exterior

■ Access to the busbars is possible via the removable roof on each functional unit.



■ Protect the upper surface of the metal plates by fitting a temporary wooden floor panel.



■ Unscrew the 10 fixing screws for each roof to gain access to the busbar.



### 6.5 Opening the door of the functional unit

Recover the key and the operating handle from the accessories pack.

- Insert the key into its keyhole.
- Turn it in an anti-clockwise direction to unlock the door.



- Insert the handle into its hole.
- Turn it upwards: the door lifts up.

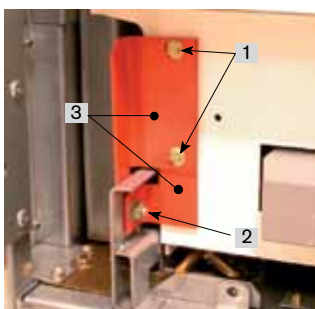
- Open the door: the handle can be removed but the key remains captive.

### 6.6 Removing the straps on the moving part compartment

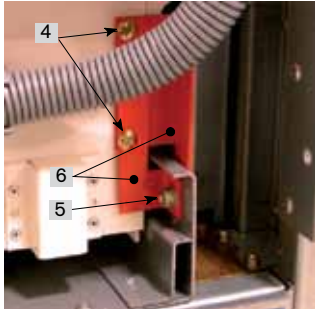


For functional units with a width of 650, 750 and 800 mm, the circuit breaker may be delivered strapped into its compartment.

- Door open: the strapping points are located on the lower left and right hand sides



- Unscrew the 2 screws (1) (Torx 25 screwdriver).
- Unscrew and remove the bolt H M8x25 (2).
- Remove the 2 strapping brackets (3).
- Screw in the 2 screws again (1).



- Unscrew the 2 screws (4) (Torx 25 screwdriver).
- Unscrew and remove the bolt H M8x25 (5).
- Remove the 2 strapping brackets (6).
- Screw in the 2 screws again (4).

### 6.7 Extracting the moving part from its compartment

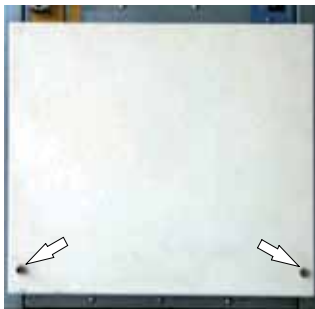


To extract the moving part from its compartment, apply the instructions § 14.3 & 14.4.

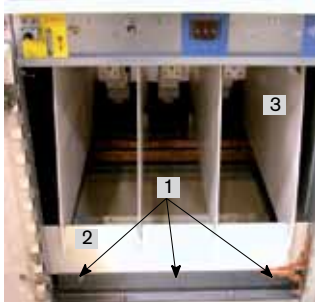
### 6.8 Removing the removable floor



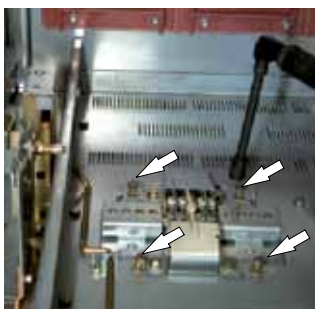
If the functional unit is provided with a locking device by a lock on the earthing switch, lock this earthing switch in the "Open" position, then remove the key from the lock.



- Unscrew the 2 (or 3) fixing screws (8 mm Allen key) from the cable compartment panel.
- Lift up and remove the panel.
- Mark the panel in relation to the appropriate functional unit.

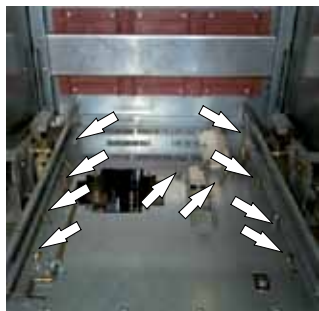


- Insulating screens in 17-24 kV:
  - remove the 3 fixing screws (1) from the support (2) for the screens (3),
  - remove the support,
  - remove the 4 insulating screens.

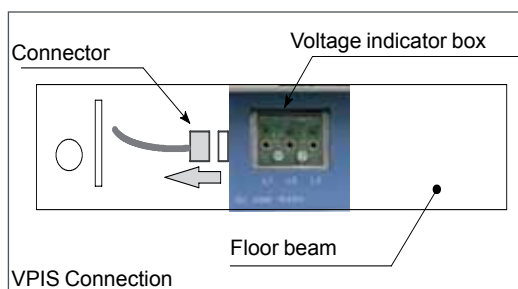


- From inside the moving part's compartment, remove the signalling contacts unit (1 screw, 13 mm spanner).
- Suspend wiring harness within cable compartment.

## 6 Installation (contd.)



- Remove the 10 fixing screws from the removable floor (13 mm spanner).



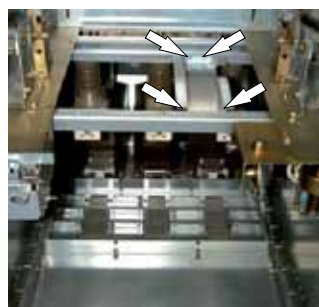
- In the case of a voltage presence box (VPIS or VDS), disconnect the wiring before removing the flooring.



- Lift up the floor panel.



- Pull the floor panel towards you and slide it out of the compartment.

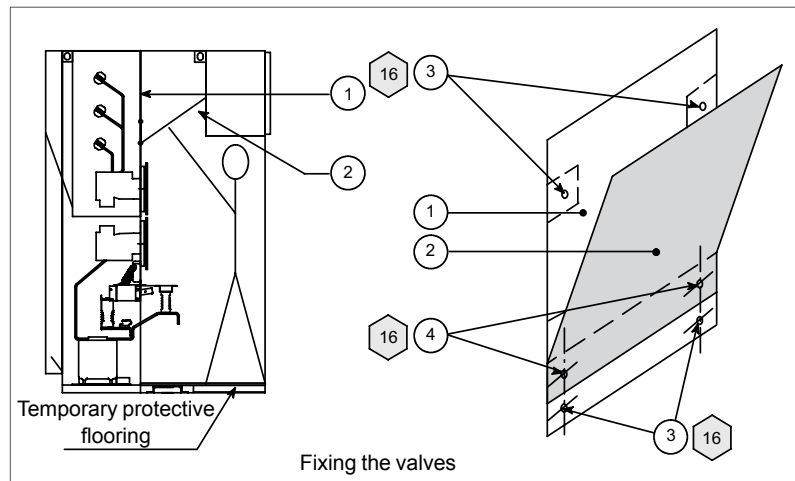


- Remove the 4 fixing screws to remove the support cross-bars (10 mm spanner).

## 6.9 Preparation of the Busbar connection: access by the interior



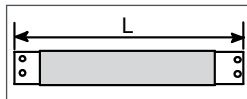
In order to connect up the busbar and before penetrating the cable compartment, install a temporary floor panel (planks of floor grating), in order to protect the bottom metal plates and the cable passage.



Proceed with dismantling the two internal arc valves.

Unscrew the 2 screws H M8x25 (4) (13 mm spanner) fixing the valves to the moving part compartment (2). Remove this valve.

Unscrew the 4 screws H M8x25 (3) (13 mm spanner) fixing the valves to the busbar compartment (1). Remove this valve: access to the busbar is now possible.



## 6.10 Marking out the length of the bars

Between functional units		L (mm)		
Width (mm)	Width (mm)	Phase L1	Phase L2	Phase L3
650	650	644	644	644
650	800	696	719	744
800	800	794	794	794
650	1000	888	819	750
750	750	744	744	744
750	1000	913	869	825
800	1000	850	894	938
1000	1000	994	994	994

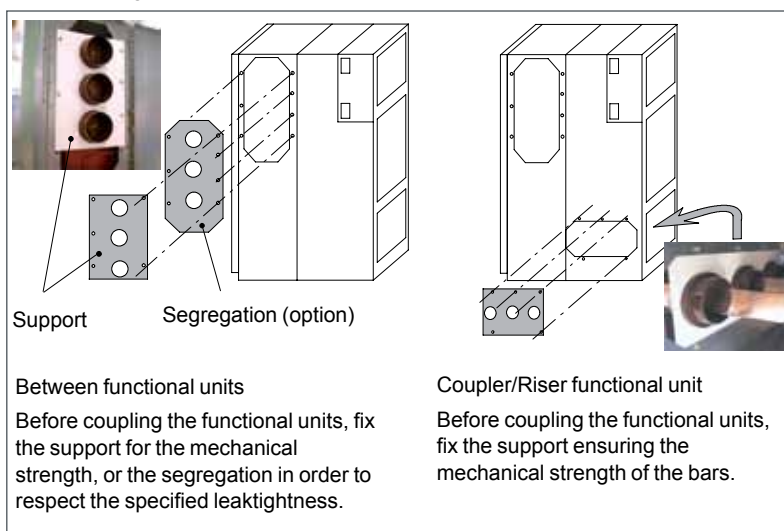
## 6.11 Lay-outs depending on the number of bars

Number of bars:	1 bar	2 bars	3 bars
Cross section (mm <sup>2</sup> )	80x10	80x10	80x10
Arrangement of busbars to vertical connections			

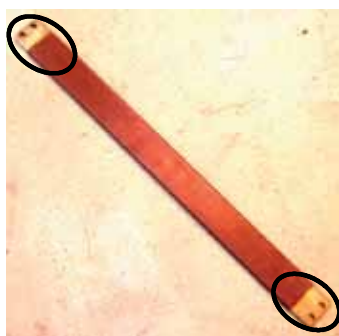
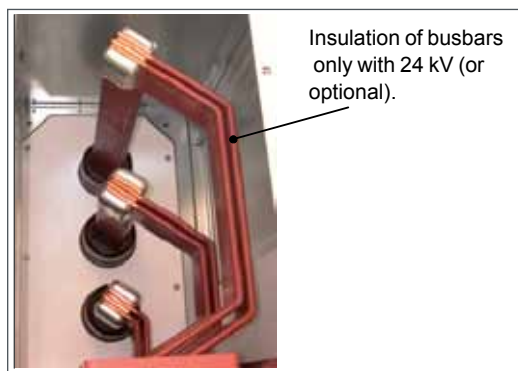
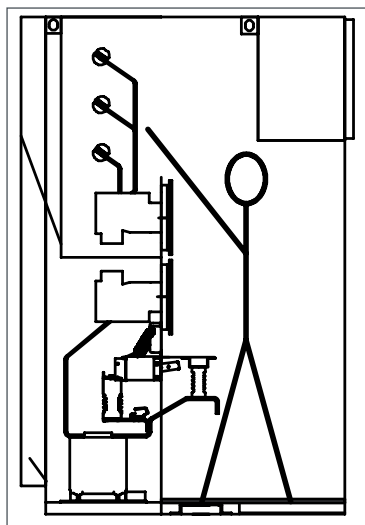
## 6.12 Mounting of the support or segregation of the busbars

The busbar section segregation an optional equipment (at customer's request). The retaining plate is only required to ensure the mechanical stability of the 3150 A busbars.

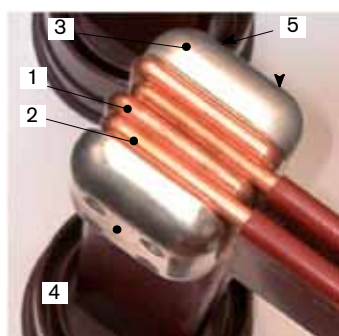
The retaining plate is installed on principle for the coupler panel.



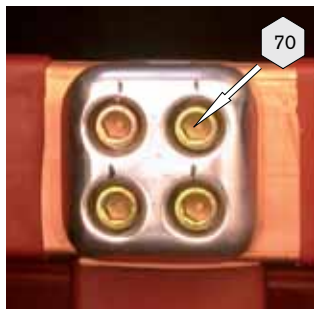
### 6.13 Example of a busbar connection



- Before assembly, lightly brush the busbars contact areas with vaseline.



- Connect up each bar (1) on to its by-pass (2):
- 3 Upper connector housing with screw head housing.
- 4 Lower connector housing with 4 tapped holes.
- 5 Fix the assembly by 4 CHC M12 screws + 4 ES 12 washers.

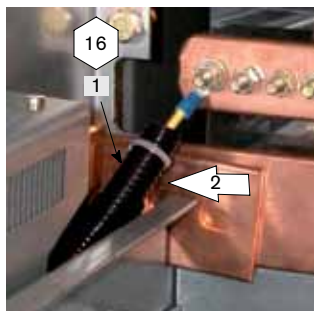


- Assembly and tightening of the 4 screws (10 mm Allen key).
  - busbar : 45 mm screw,
  - busbars : 55 mm screw.

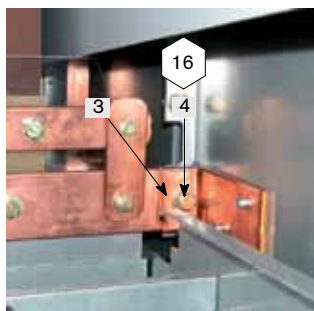
### 6.14 Remounting the internal arcing valves

At the end of this work, proceed with re-assembly in the reverse order to the operations described above (see § 6.9).

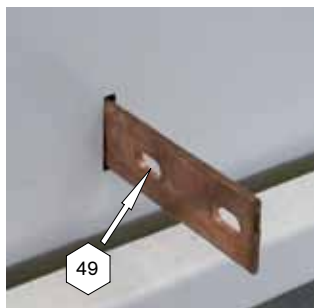
### 6.15 Connecting up the earthing circuit



- To connect two functional units together:
  - 1 Unscrew the bolt H M8x35 (13 mm spanner) retaining the busbar link.
  - 2 Slide this link through the functional units flange.



- In the adjacent functional unit:
  - Unscrew the fixing screw.
  - 3 Adjust the busbar link with the aid of slotted holes.
  - 4 Bolt the busbar link on the 2 sides and tighten to indicated torque.



- Connect the earthing circuit linking all of the functional units to the room's earthing bar (Threaded fasteners H M12 and earthing cables not supplied).



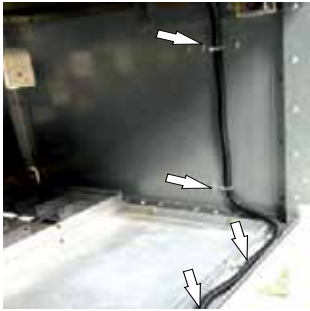
### 6.16 Connection of the cables on functional units with solid flooring



In order to gain better access to the cables, remove the removable floor panel (see section 6.8).

#### Presence of micro-switches on the earthing switch

- Preliminary operation: if the earthing switch is equipped with positioning micro-switches, remove the power supply wiring strands.
- Remove the collars retaining the sheath (cutting pliers).



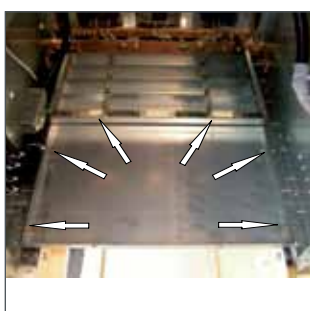
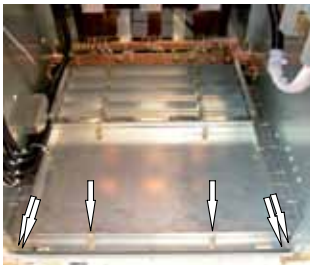
- Dismantle the micro-switch's protective cover.



- Disconnect the sheath from the micro-switch's terminal block.
- Pull out the wiring strands.

#### Fitting the cables in place

- Remove the lower front cross-bar (6 screws H M8x25, 13 mm spanner).



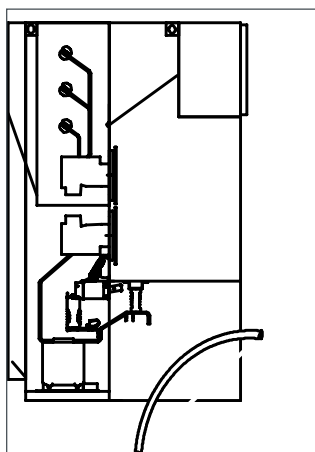
- Remove the front floor panel (6 screws H M8x25, 13 mm spanner).



## 6 Installation (contd.)



- Dismantle and recover the clamping collars as well as the grommets.
- Extract the bottom metal plates.



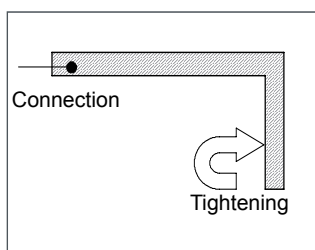
- Pass each cable by the floor openings and bring it out by the front of the compartment to make up the cable ends.



- Cut out the grommet to the diameter of the cable.
- Fit this blanking piece on to the cable.

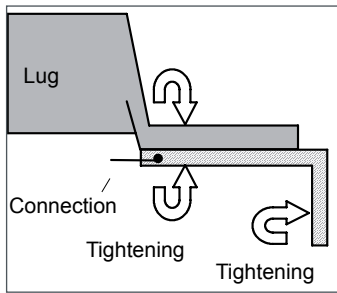


- Make up the cable end (fitting and crimping of the lug) in accordance with the cable supplier's recommendations.

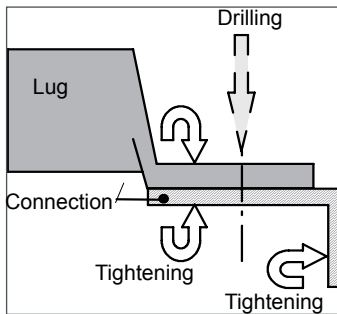


### Preparation of the undrilled connector connections

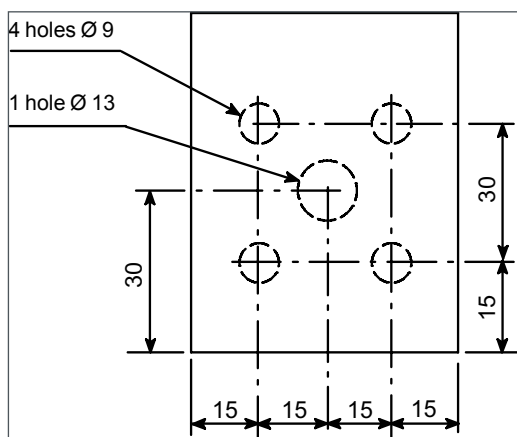
- Remove and tighten the connector in a vice (whilst taking care to protect it).



- Position and fix the lug to the said connector with quick tightening pliers.



- Punch and drill the holes by using those on the lug for centring.



## Two examples of drillings

Connection with 1 hole Ø 13 for:

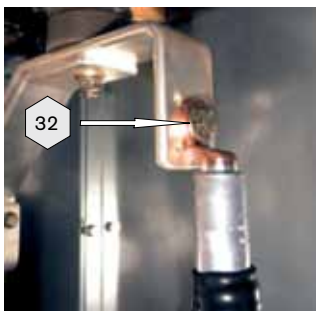
- all lugs < 240 mm<sup>2</sup>
- 300 und 400 mm<sup>2</sup> aluminium/copper lugs

Connection with 4 holes Ø 9 for:

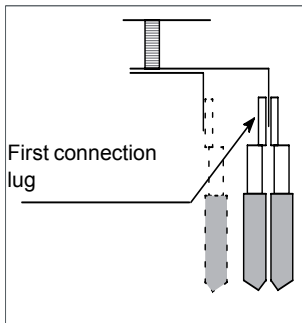
- 500 und 630 mm<sup>2</sup> aluminium/copper lugs
- 300 und 400 mm<sup>2</sup> aluminium lugs

## Fixing the cables

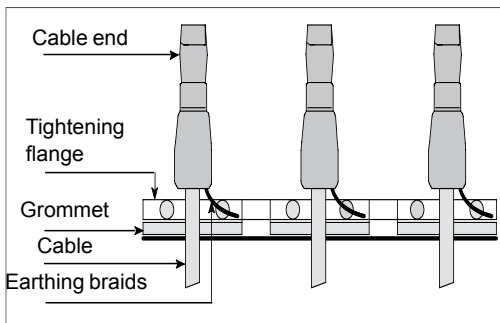
- Fix each cable to its connection lug:
  - for cable > 400 mm<sup>2</sup> (4 screws H M8, class 8.8, tightening torque: 16 N.m).



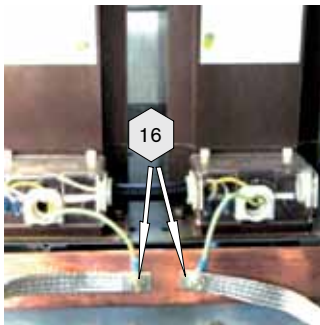
- For cable ≤ 400 mm<sup>2</sup> (1 screw H M10, class 8.8).



- Assembly of 2 cables per phase: connect up the 2 cables to the first connection lug.



- Carry out the flanging for each cable on the cable itself.



- Connect the 3 earthing braids to the functional unit's earthing circuit (screw H M8x25).

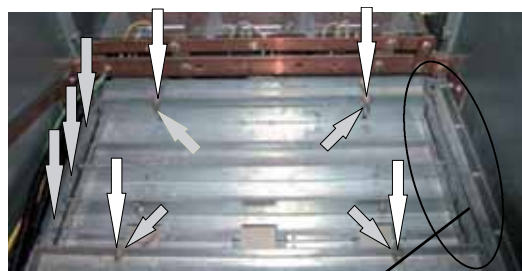


The earthing braids for the cables absolutely must pass above the bottom metal plates.

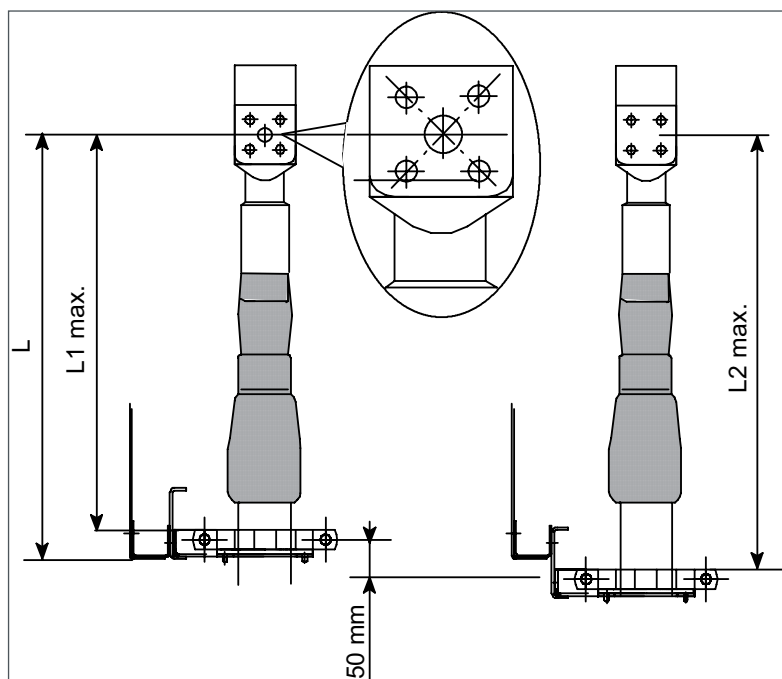
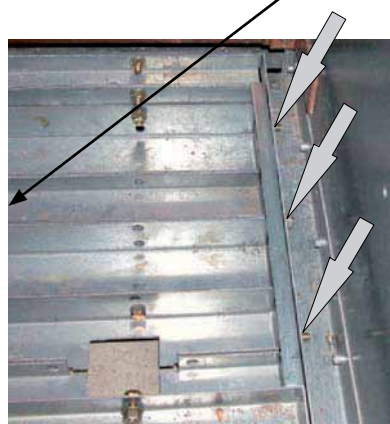


Do not stick the phase markers (coloured adhesive tape) on the reassemblies.

## Case of an assembly with a lock cup (adjustment)



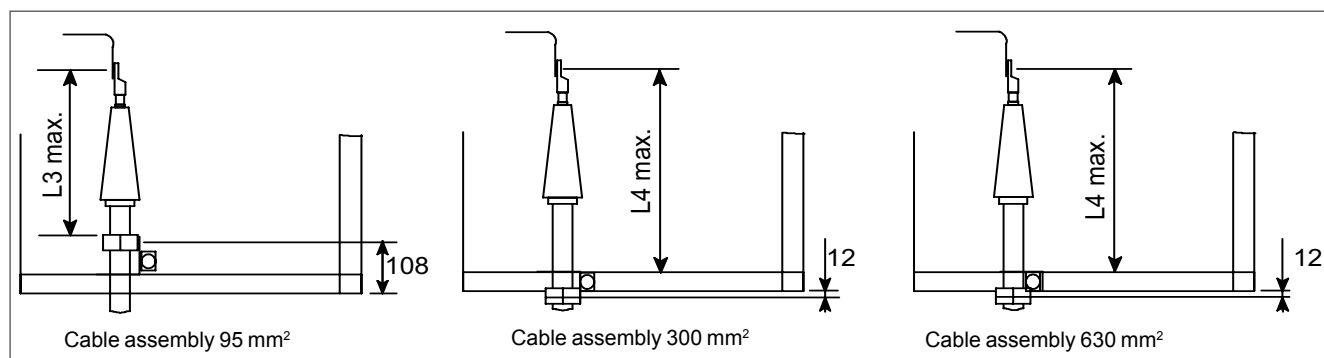
Fastening detail



Connection distances (mm)

	PIX12	PIX17	PIX24
L	430	460	555
L1	390	420	515
L2	440	470	565

## 6.17 Connection of the cables on functional units without a rear flooring panel



Connection distances (mm)

	PIX12	PIX17	PIX24
L3	290	320	415
L4	410	440	495

## 6.18 Remounting the drawing unit support

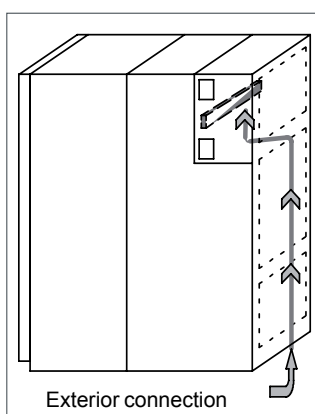
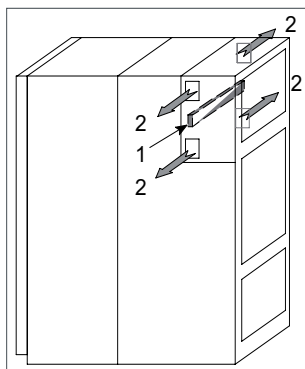
For remounting, reverse the order of steps according to § 6.8.



Perform mechanical function tests again with drawing unit (racking in/racking out).

## 6.19 Connection of low-voltage cables in the switch cabinet

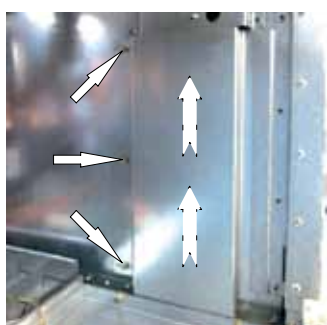
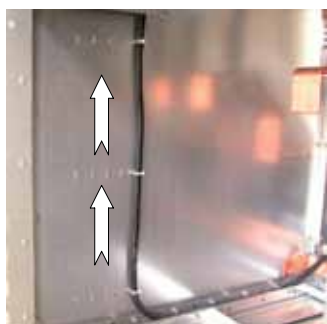
- Access the terminal block (1) by the door on the box.
- Connect up the links between the functional units by passing through the side openings (2) on the box.



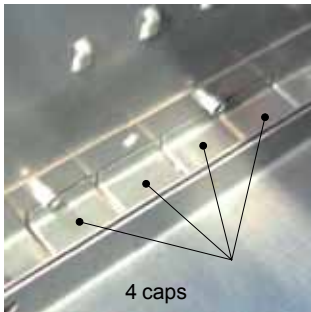
- The customer can carry out the connection of exterior cables by the cable trough (see § 6.20).

## 6.20 Passage of the LV cables in the cable compartment

- Lower panel removed to gain access to the wiring ducts.
- Left-hand side: no lower duct, reserved for Schneider Electric low voltage cables.

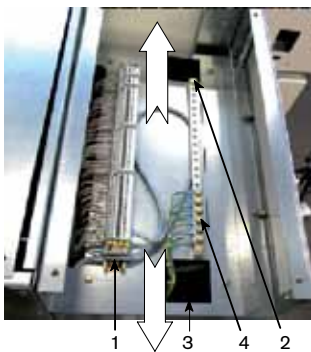


- Right-hand side: reserved for passage of cables by the customer.
- Protection by a removable duct fixed by 3 M6 nuts (10 mm spanner).

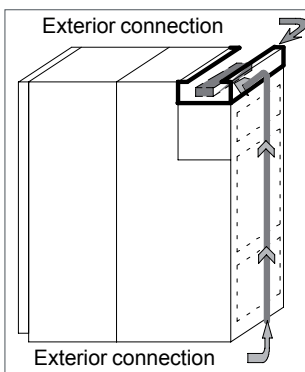


- Cut the caps as required to enable the low voltage cables to exit the functional unit.
- Plug up the opening, around the cables, in order to preserve the specified protection index.

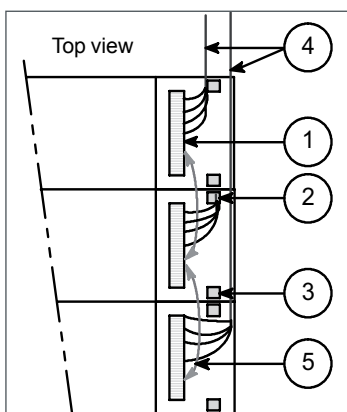
## 6.21 Connection of a low voltage circuit in an upper cable trough



- Access the terminal block (1) and the ground bus (4) by removing the cover on the upper wiring trough (4 screws H M6x20).
- Connect up the links between the functional units by passing directly from one wiring trough to the other.
- 2 et 3- Wiring troughs (see § 6.20).



- The customers can establish the external cable connections on their own.
  - either by the cable trough, by remounting through the righthand wiring duct (see § 6.20).
  - or from an upper cable trough and by the roof of the functional unit.



### Legend

- 1 Terminal block
- 2 Wiring trough (right-hand)
- 3 Wiring trough (left-hand)
- 4 Customer's connection
- 5 Inter-functional unit connections

## 6.22 Assembly of an internal arc deflector (optional)

The deflector is installed in the roof of the low voltage box, whenever all of the connections have been carried out (see § 6.2).

## 6.23 Assembly of 24 kV insulating screens

In the cable compartment, proceed with remounting the 4 insulating screens (see § 6.8).

## 7.1 Transport trolley for truck

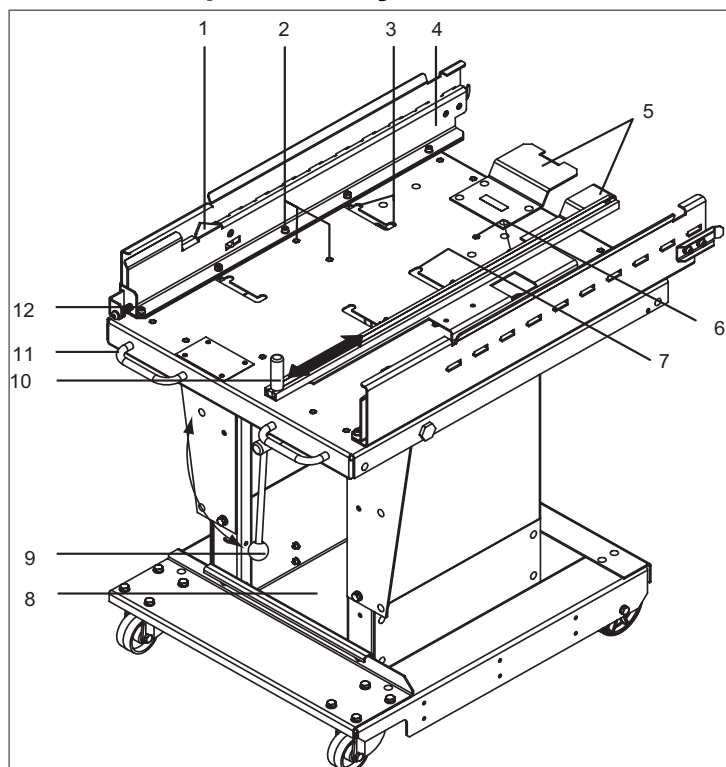


Fig. 12.1

Transport trolley for truck

- 1 Autonomous interlocking of the racked-in truck on the trolley
- 2 Variable screw fastening of track
- 3 Positioning of track to adjust the various track widths
- 4 Track
- 5 Interlocking with panel
- 6 Variable screw fastening of unlocking bar
- 7 Positioning of unlocking bar to match various panel versions
- 8 Tray for accessories (lever, keys, handle)
- 9 Lever to lock / unlock the transport trolley on the panel. Table of trolley is lifted or lowered.
- 10 Unlocking bar. The truck is unlocked in the panel.
- 11 Handles of trolley
- 12 Slide to unlock the truck from the trolley

Rated voltage $U_r$ of the panel [kV]	Panel width [mm]	Truck	Item number of trolley
$\leq 12$	650/800	HVX/UTX/MTX/CVX	EIB AE1 148-01 <sup>1</sup>
	1000	HVX/UTX ( $I_r = 2500$ A)	EIB AE1 148-02
		HVX/UTX ( $I_r = 3150$ A)	AGS C74 125-01
$\leq 17.5$	750	HVX/UTX/MTX/CVX	EIB AE1 148-01 <sup>1</sup>
	1000	HVX/UTX ( $I_r = 2500$ A)	EIB AE1 148-02
		HVX/UTX ( $I_r = 3150$ A)	AGS C74 125-01
24	800	HVX/UTX/MTX/CVX	EIB AE1 148-01 <sup>1</sup>
	1000	HVX/UTX ( $I_r = 2500$ A)	EIB AE1 148-02

### Adjusting the track width

<sup>1</sup> The trolley can be used for panel widths of 650, 750 and 800 mm:

- Release 3 screws on each track (Fig. 12.1, 2).
- Adjust the two tracks to the appropriate panel track width and check them. Re-mount the six screws.
- Adapt position of unlocking bar (10) also to the appropriate panel (same procedure).

### 7.2 Operating accessories

- Opening and closing handle for the door



- Standard key\* to lock and unlock the door of the "drawing unit" compartment



- Standard key\* to lock and unlock the low-voltage switchgear



- Re-arming lever for the springs on the circuit breaker's BRH mechanical control mechanism



- Lever:
  - for closing and tripping the circuit breaker,
  - for tripping the GFX







- Standard\* operating lever for the earthing switch



- Disengageable plugging-in and withdrawing crank handle for the circuit breaker's moving part.

References:

FPX & UTX with pincers - MTX - GFX



End-piece



FPX & UTX with bell ends



End-piece



\* Other keys or levers may be delivered depending on the contract

Accessories delivered with the equipment and the only ones approved for use on Schneider Electric products

## 8 Operating and handling instructions



Opening the door is only authorised for maintenance operations (see § 15).



Respect the locking out procedures for interventions with equipment energised.

Operating functions must be carried out with the door of the functional unit **closed**.

### 8.1 Plugging-in operation for the moving part

■ Pass the crank handle through the hole in the door and introduce it into the moving part's drive shaft.

■ Turn it in the direction of the arrow: the crank handle slowly penetrates into the compartment.

■ The CLACK of the disengagement of the crank handle indicates that the moving part is "plugged-in".

■ Remove the crank handle.

### 8.2 Unplugging operation for the moving part (compulsory before opening the door)

■ Pass the crank handle by the hole in the door and introduce it into the moving part's drive shaft.

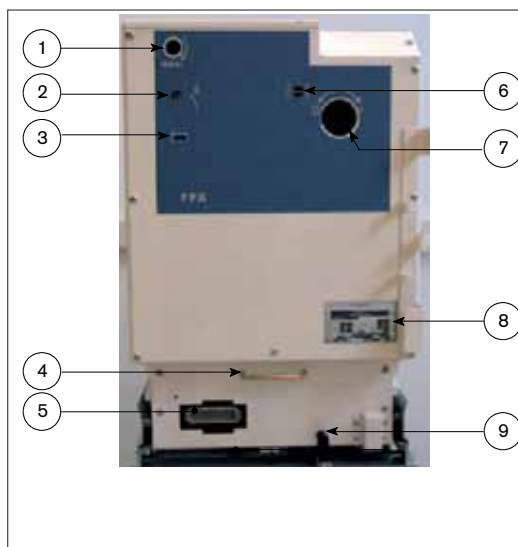
■ Turn it in the direction of the arrow: the handle slowly leaves the compartment.

■ The CLACK of the disengagement of the crank handle indicates that the moving part is "withdrawn".

■ Remove the crank handle.



## 9 Operation of the FPX moving part



### Legend

- 1 Location of the arming lever
- 2 Indicator light for the state of the circuit breaker (closed or tripped)
- 3 Operating counter
- 4 Handling handle
- 5 Low voltage plugging-in socket
- 6 Indicator light for the state of the springs (armed or released)
- 7 Manual closing and tripping handling button.
- 8 Technical data rating plate
- 9 Location for the plugging-in crank handle

### 9.1 Manual arming of the circuit breaker (door open or closed)



Operation that can be carried out with the circuit breaker in the position "withdrawn/test".

- Fit the arming lever into its housing.



- Turn the lever alternatively from top to bottom until the mechanism makes a loud "CLACK" sound.



## 9 Operation of the FPX moving part (contd.)



- The spring is “armed”: do not apply any more effort on the lever.
- Remove the arming lever.

### 9.2 Closing and tripping the circuit breaker (door closed)

- Arm the BRH mechanical control mechanism on the FPX.
- Fit the closing and tripping lever into its orifice through the door.
- Introduce the lever into the axis of the operating button.

#### ■ Closing

To close the circuit breaker, turn to the right, following the arrow “I”.

- The state of the circuit breaker is visible through the view port in the door.



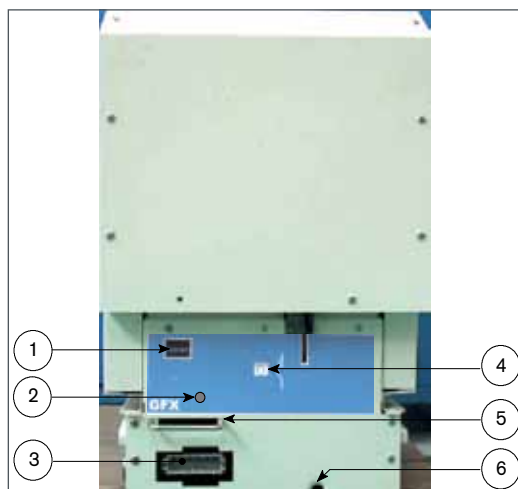
#### ■ Tripping

To open the circuit breaker, turn to the left, following the arrow “O”.

- The state of the circuit breaker is visible through the view port in the door.



# 10 Operation of the GFX moving part (for 12 kV switchgear)



## Legend

- 1 Operating counter (optional)
- 2 Location of the tripping lever (only on a latch-in contactor)
- 3 Low voltage plugging-in socket
- 4 Indicator light for the state of the contactor (closed or tripped)
- 5 Handling handle
- 6 Location for the plugging-in crank handle

## 10.1 Operation of the contactor (door closed)

### ■ Magnetic action contactor:

- closing and tripping by electrical order.

### ■ Latch-in contactor:

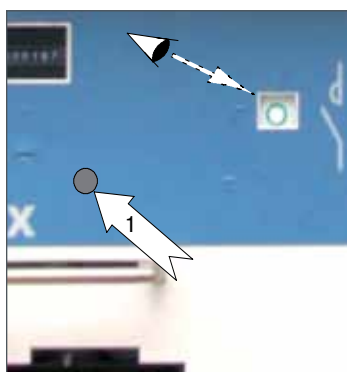
- closing by electrical order,
- manual tripping.

### ■ Tripping

Take the lever and fit it through the door.

### ■ Press 1.

■ The tripped state (O) of the contactor is visible through the view port in the door.





## 11.1 Operating accessories

- Handle for opening and closing the door.



- Standard key\* to lock and unlock the door.



- Standard key\* to lock and unlock the low-voltage switchgear.

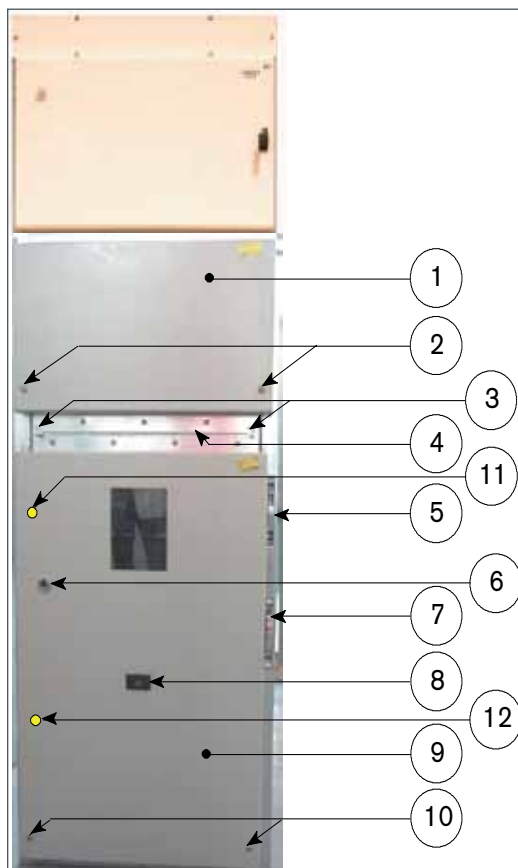


- Operating levers.



- Red insulating plate for compartmentalisation with instructions label.

\* Other keys may be delivered depending on the contract.



## 11.2 Presentation of the functional unit

### Legend

- 1 Access panel to the busbars
- 2 Fixing screws for the busbar panel
- 3 Valve pull control devices
- 4 Middle rail with sealing valve
- 5 Switch opening and closing mechanism
- 6 Location for the door handle
- 7 Earthing switch opening and closing mechanism
- 8 Location for the door key
- 9 Functional unit door
- 10 Door fixing screw
- 11 Switch position indicator
- 12 Earthing switch position indicator

## 11.3 Reception and opening of the functional unit's door (see marks on § 11.2)

Recover the key, the handle and the operating levers from the accessories pack. Unscrew the fixing screws (10) from the door (9). Insert the key into its keyhole (8). Turn in a clockwise direction. Insert the handle into its hole (6). Turn it upwards: the door lifts up. Open the door: the handle and the key remain captive.

## 11.4 Access to inside the functional unit (refer to the marks in § 11.2)

- Door open, fuses removed.

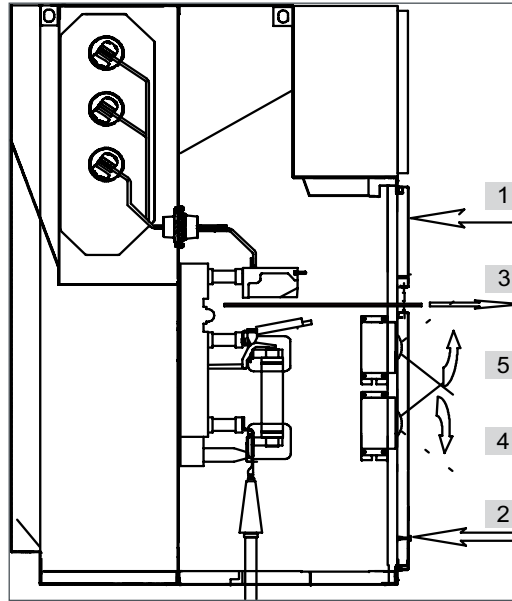


- To remove the busbar's upper panel, unscrew the 2 nuts (2).

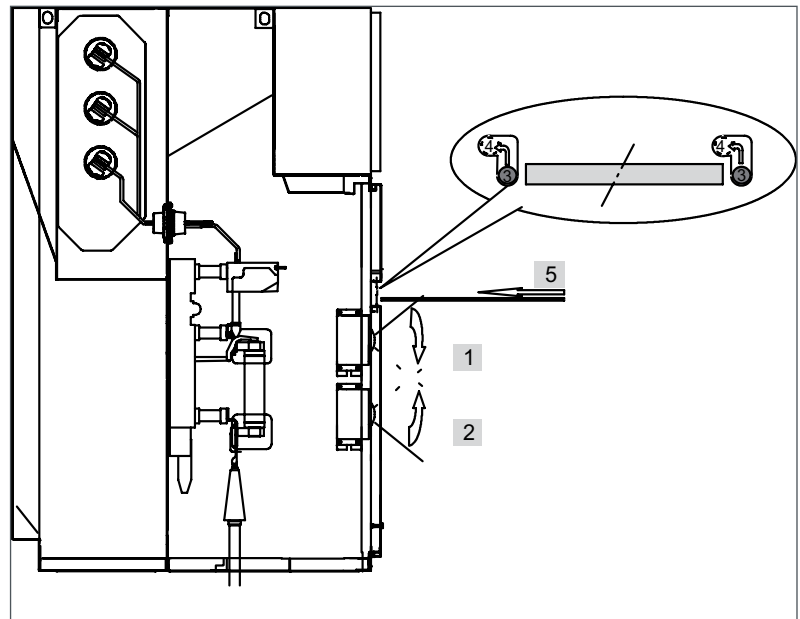
- Lift up the middle cross-bar (4) and pull it towards you to remove it.

## 11.5 Commissioning the functional unit

- 1 Set in place and fix the busbar panel.
- 2 Close and fix the door in place.
- 3 Remove the red insulating plate for compartmentalisation: the sealing valve falls down by itself.
- 4 Open the earthing switch.
- 5 Close the switch.



## 11.6 Switching OFF the panel



- 1 Open the switch.
- 2 Close the earthing switch.
- 3 Take hold of the 2 shutter lifting rods.
- 4 Lift the rods and hook them into the notches.
- 5 Fit the red insulating plate for compartmentalisation.



## 12 Standard locking out and interlocking procedures

### 12.1 Operating mechanical interlocking

The PIX functional units are equipped with mechanical function interlocks, intended to avoid any kind of operating error.



These interlocks must be known before any operation is performed.

Interlocking	Function	Functioning
■ Between the plugging-in of the moving part and the installation of the low voltage plug.	■ The plugging-in of the moving part is impossible if the low voltage plug is not connected up.	■ The shutter for access to the plugging-in control is locked.
■ Between the plugging-in of the moving part and the earthing switch "closed".	■ Plugging-in of the moving part is impossible if the earthing switch is closed.	■ The plugging-in crank handle disengages.
■ Between the closure of the earthing switch and the position of the moving part.	■ Closure of the earthing switch is impossible as soon as the moving part is in the course of being plugged in or is "plugged-in".	■ Operating the control lever for the earthing switch is impossible: Do Not Force It !
■ Between the plugging-in and the closed state of the moving part.	■ Plugging-in of the moving part is impossible if the latter is closed.	■ The shutter for access to the plugging-in control is locked.
■ Between the closing of the moving part and plugging-in.	■ Closing of the moving part is impossible outside of the "Plugged-in" or "Test" positions.	■ Electrical and manual command controls of the moving part are impossible.

### 12.2 Mechanical function interlock of panel L-TRI

Interlocking	Function	Functioning
■ Between disconnector, door and earthing switch.	■ Disconnector ON	■ The earthing switch is OFF.  ■ The door is closed. ■ The add-in board has been removed.
■ Between disconnector and earthing switch	■ Earthing switch ON	■ The disconnector is OFF.
	■ Add-in board present	■ The disconnector is OFF.
■ Between the add-in board and the door	■ Access to inside of cable compartment	■ The add-in board is present. ■ The earthing switch is ON.

## 12 Standard locking out and interlocking procedures (contd.)

### 12.3 Locking out by padlock (not supplied) and by locks



The passage holes are provided to accept the shackle for padlocks of 8 mm Ø.



The fitting of several padlocks on a single point necessitates the use of an accessory that is not supplied.

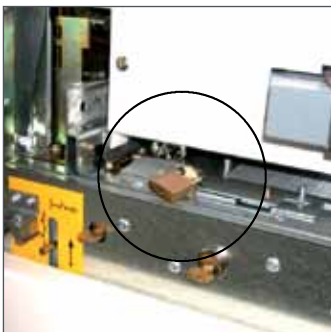
- Mechanical lock-out of earthing switch by padlocks and other locks



- Mechanical lock-out for shutter (same principle for left-hand and right-hand)

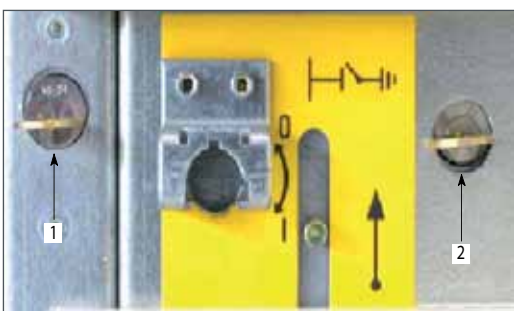


- Locking-out of the plugging-in

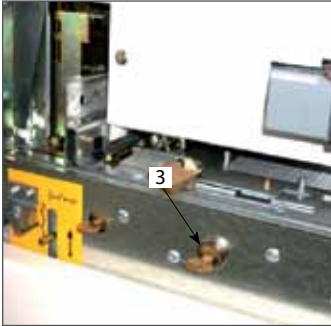


### 12.4 Interlocks using keylocks

- 1 Locking the earthing switch in the closed position.
- 2 Locking the earthing switch in the open position.



## 12 Standard locking out and interlocking procedures (contd.)



■ Rack-in interlock

### 12.5 Additional locking out and interlocking procedures

Other locking-out and additional locking devices can be supplied depending on the particular specifications of the contract.

### 12.6 Mechanical lock-out due to padlocks (not included in scope of supplies)



Through-holes are provided for 8 mm thick bars of padlocks.



If several padlocks are used in one location, an accessory (not included in scope of supplies) is used.

# 13 Commissioning

## 13.1 Important notes

Prior to dispatch, PIX functional units are mechanically and electrically tested.

If the material has been stored in a damp location, it is recommended that the room be heated and the heating coils be energized for a period of 24 hours prior to installation.

Also check the leaktight devices in the room, the cable troughs, ventilation etc.

## 13.2 Inventory of tools and accessories on completion of work on site

Recover, draw up an inventory and tidy away all assembly tools and objects not required in the switchboard.

Return the functional unit's and circuit breaker's operating accessories to their respective storage positions

Post the technical Manual PIX in a clearly visible position.

## 13.3 Pre-commissioning information

Respect the General Safety Instructions for Electrical Applications and the specific regulations for the network with regard to lock-outs.

Record the serial numbers and identifying marks on equipment and switchgear while they are accessible. Tests and trials have already been carried out in the factory.

Check with the plans and diagrams supplied along with the material. They will describe the functionalities employed to carry out the level of operation required.

## 13.4 Principle pre-commissioning checks

Visual inspection	Date	Remarks	Signature
<ul style="list-style-type: none"> <li>■ Ensure there are no foreign bodies within the switchboard</li> <li>■ Check the external appearance (no signs of blows, scratches on the paintwork) - &gt; carry out repairs if needed.</li> <li>■ Check the conformity with the protection index (leaktightness of the functional units, various blanking- off panels, etc.).</li> </ul>			

"Mechanical" checks	Date	Remarks	Signature
<ul style="list-style-type: none"> <li>■ Operating and interlock tests on the access doors and removable panels.</li> <li>■ Key-locked system tests.</li> <li>■ Checking mechanical locks, (electrical jointing, power and earthing circuits, etc.</li> </ul>			
Operations carried out on the moving parts : <ul style="list-style-type: none"> <li>■ Plugging-in and withdrawing,</li> <li>■ Connection of the LV socket,</li> <li>■ Arming, closing and tripping.</li> </ul>			

Tests and trials	Date	Remarks	Signature
Dielectric tests ■ Whilst taking all precautions necessary, carry out a dielectric test on the HV equipment and LV cabling. NB: These tests must be carried out prior to electrical testing.			
Electrical tests ■ Check the continuity of the earthing circuit. ■ Check the connections on the LV links. ■ Test the correct operation of the LV switchgear. ■ Record the relay parameters.			

State of switchgear	Date	Remarks	Signature
■ Examine each moving part, in particular the plugging in pins contacts ■ Ensure that all the circuit breakers are open and in the isolating position the earthing switches are open and the access panels to the cables and to the busbars are in place. ■ Ensure that the voltage transformer fuse indicator covers have been removed (comply with the instructions by the fuse suppliers).			

## 13.5 Energizing the "Incoming" functional unit

Energize the cables. In the case of a VPIS (IEC 61958) type voltage presence, check that the luminous indicators are flashing.

In the case of a VDS type voltage detection (IEC 61243-5, HR system, "high impedance"), successively connect up the tester to the 3 phases. Check that it lights up in every case.

Energize the busbar. To do this, plug-in and close the circuit breaker (see § Operation).

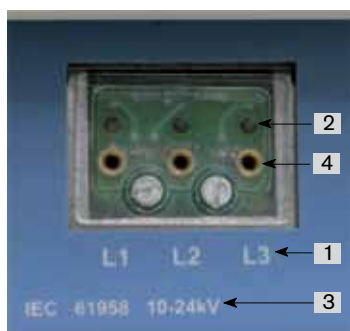
## 13.6 Voltage test (VPIS indicators)

The indication of "voltage presence" is ensured in conformity with the provisions of IEC 61958 within the range of service voltage defined on the label (3).

To each of the 3 phases L1, L2 and L3 (1) there is a corresponding flashing indicator (2).

A connection point (4), for each phase, is accessible on the front face of the luminous indicator in order to connect the phase comparator.

The indication of a VPIS, by itself, is insufficient to ensure that the system is de-energized: if the operating rules demand it, then the appropriate voltage detectors must be used to that effect, in compliance with IEC 61243-5.

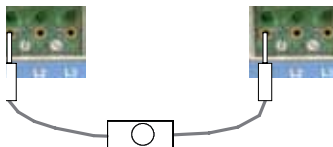
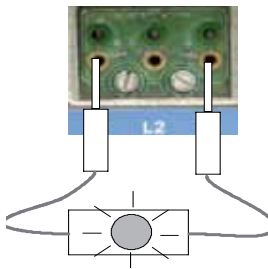


## 13.7 Energising a second “Incoming”, supplied power from the same source

Energize the cables. Check for the presence of voltage (see § 13.5). Check the phase balance (see §13.8 or 13.9) before commissioning.

## 13.8 Control of phase balance with a phase comparator (VPIS indicators)

■ Connect the 2 phase comparator cables (optional) on to 2 phases of the same functional unit. The light should light up: Showing the comparator is working.



- Phases are balanced: light out
- Phases out of balance: light on

- Check the phase balance with the aid of a phase comparator already checked. If the phases are out of balance, inspect the cable connections.
- Phases are balanced: light out
- Phases out of balance: light on

## 13.9 Voltage presence testing (VDS indicators)

- Voltage indicator housing



- Detector of the presence of voltage type KSP HR2 (optional).

## 13.10 Check phase coincidence using a phase monitor (VDS indicators)

- Phase comparator for HR system (Type ORION 3.0, Horstmann GmbH)



Phase comparators are optionally available and not included in the scope of supplies.

Make sure to check phase coincidence before connecting different supply lines for the first time.g.

## 14 Preliminary operations before maintenance

### 14.1 Opening the door of the functional unit



Opening the door is only authorised for the maintenance operations mentioned in § 13.



The moving part must be in the “withdrawn” position.

- Insert the key into its keyhole.
- Turn it in an anti-clockwise direction to unlock the door.



- Insert the handle into its hole.
- Turn it upwards: the door lifts up.



- Open the door: the handle can be removed but the key remains captive.

### 14.2 Closing and locking the door

- Close the door



## 14 Preliminary operations before maintenance (contd.)



- Move handle down: the door is lowered and locked.
- Remove handle.



- Turn the key in a clockwise direction: the door is locked.
- The key can only be removed when the door is closed.

### 14.3 Disconnection of the low voltage plug



Isolate the low voltage auxiliaries before disconnecting the moving part's plug.

- Door open: moving part in the position "withdrawn/test" with low voltage plug connected.



- Pull horizontally on the low voltage plug unlocking lever.



- Disconnect the plug.



## 14 Preliminary operations before maintenance (contd.)



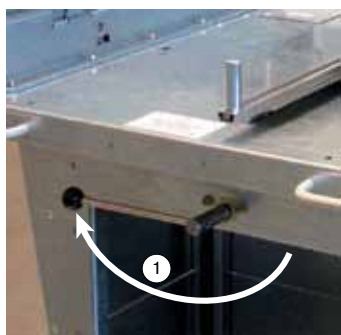
- Remove the wiring sheath.



- Raise and store all of the low voltage connections in the space reserved for it above the moving part.

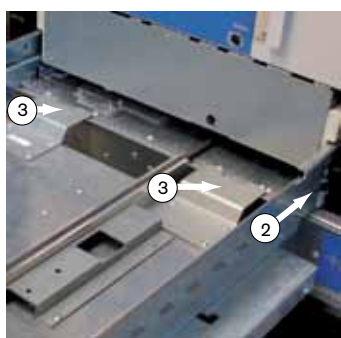


- Low voltage plug stored in its housing.



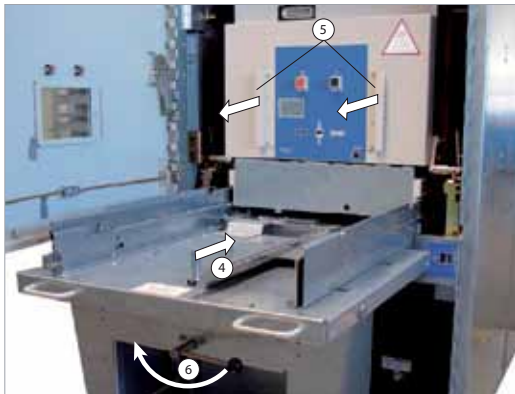
### 14.4 Removing the truck from the panel

- Adjust rails and unlocking bar of trolley to the correct track width of the truck (see Chapter 7.1).
- Turn lever to the left (picture left, 1). The trolley is lifted on the front.

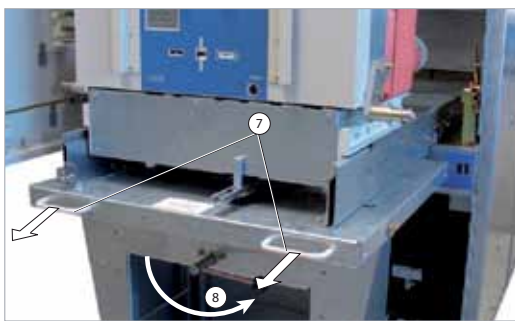


- Approach trolley to the panel so that the lateral guides (picture left, 2) are close to the panel, and turn lever (1) back to the right. The trolley is locked on the panel (3).

## 14 Preliminary operations before maintenance (contd.)



- Push unlocking bar (picture left, 4) forward to its stop. The latching of the truck in the panel is released.
- Turn lever back to the left (6). The trolley is lifted on the front, and removed from the panel.
- Pull truck (HVX, CVX, FPX, GFX) onto the trolley via the handles (5) until it snaps in on the trolley audibly.

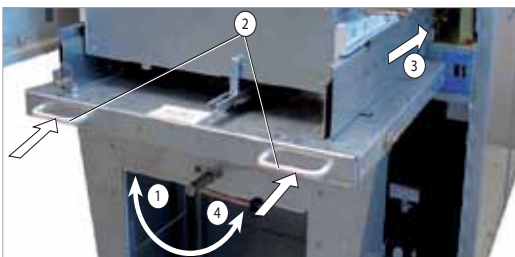


- Pull trolley with the truck away from the panel (7) and turn lever back to the right to lower it (8).
- Now the truck can be raised by means of a crane, and deposited. For further information, please refer to Chapter 5.5.

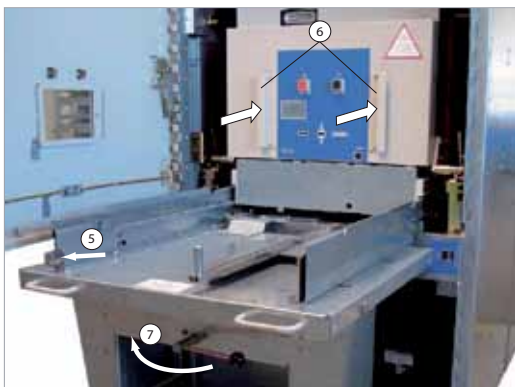
### 14.5 Inserting the truck into the panel



Trucks and panels can be given matching coding, optionally. This is to prevent a truck from being racked completely into the panel if the rated data do not match.



- Turn lever to the left (picture left, 1). The trolley is lifted on the front.
- Approach trolley to the panel via the handles (2) so that the lateral guides (3) are close to the panel, and turn lever back to the right (4). The trolley is locked on the panel.



- Press left-hand unlocking button (picture left, 5) and slip truck briefly beyond the ratchet lever. Subsequently, slide truck into the panel using the handles (6), until it is latched in the panel.
- Turn lever back to the left (7). The trolley is lifted on the front, and removed from the panel.
- Pull trolley back from the panel and turn lever back to the right to lower it.

## 14 Preliminary operations before maintenance (contd.)

### 14.6 Connection of the low voltage plug



Ensure that the low voltage auxiliaries are cut off before connecting the low voltage plug.

- Pull out the low voltage plug from its housing.



- Fit the wiring sheath into the hooks fixed on to the moving part's front plate.



- Present the low voltage plug facing its socket.



- Plug in the plug and pull the lever down.



# 14 Preliminary operations before maintenance (contd.)



- The low voltage plug is locked.

## 14.7 Earthing switch opening operation

- The hole for the earthing switch's operating lever is still blanked off.

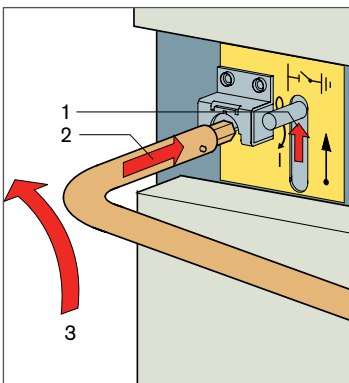


- Moving part "withdrawn": it is possible to remove the blanking off piece by raising the pull control device.



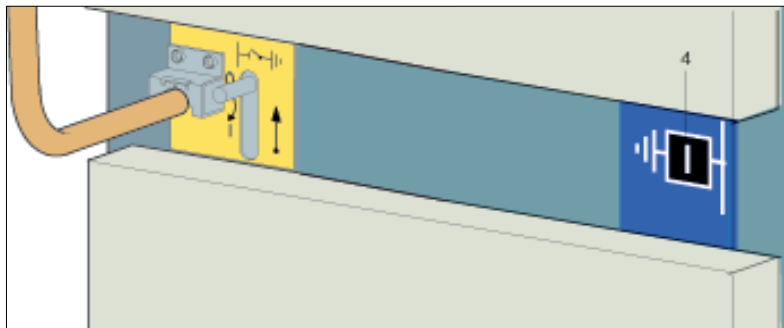
Observe the interlocking conditions (Chapter 12).

- Push the slide (picture left, 1) upwards and insert the control lever of the earthing switch with the lever rod pointing to the right (2).
- Press the lever counterclockwise by approx. 95° (3).



# 14 Preliminary operations before maintenance (contd.)

- Check position indicator: It must indicate that the earthing switch is OFF (picture down, 4). Remove crank.



## 14.8 Earthing switch closing operation



Before closing the earthing switch, ensure there is complete absence of voltage in the circuit concerned.

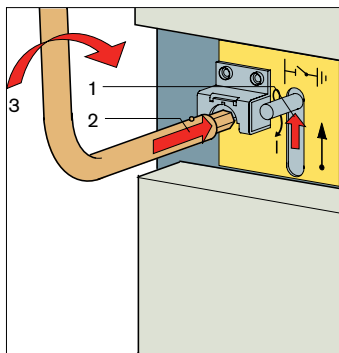


Observe the interlocking conditions (Chapter 12).

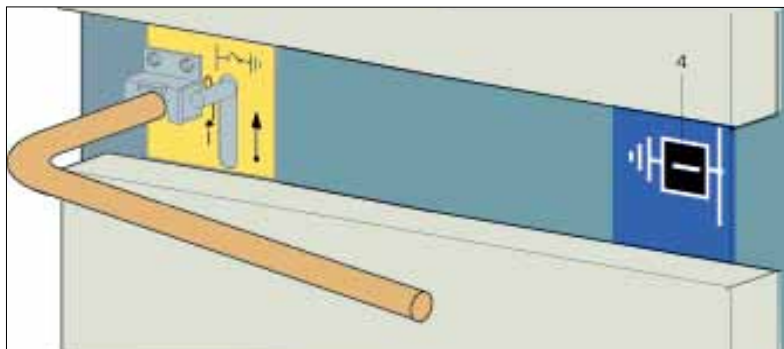
### Initial situation:

- Circuit-breaker OFF
- Truck in disconnected position

- Push the slide (picture down, 1) up wards and insert the control lever of the earthing switch with the lever rod pointing upwards (2).
- Press the lever counterclockwise by approx. 95° (3).



- Check position indicator: It must indicate that the earthing switch is ON (picture down, 4). Remove crank.



## 15.1 Levels of maintenance

Definition	Levels
Operations recommended in the instructions manual "installation - operation - maintenance", carried out by suitably qualified personnel having received training allowing them to intervene whilst respecting the safety rules.	1
Complex operations requiring expertise and the implementation of support equipment in accordance with Schneider Electric's procedures. These are carried out by Schneider Electric or by a specialised technician, trained by Schneider Electric in the implementation of procedures, and who is equipped with specific equipment.	2
All preventive and corrective maintenance, all renovation and reconstruction work is carried out by Schneider Electric	3

## 15.2 Preventive maintenance of the moving parts

Please refer to the specific instruction manuals (§ 2.4).

Preventive Maintenance	Frequency		Levels		
Recommended operations	3 years	6 years	1	2	3
Removal of dust from the insulating enclosure of the poles (clean, dry cloth)	■	-	■	■	■
Checking the state of the plugging-in clamps	-	■	-	-	■
Checking the moving part's earthing switch device (clamps and contact jaws)	-	■	-	-	■

## 15.3 Preventive maintenance of the functional units

Preventive Maintenance	Frequency		Levels		
Operations recommended at the functional unit level	3 years	6 years	1	2	3
Verification of the presence and condition of accessories (levers, etc.)	■	-	■	■	■
Visual inspection of exterior appearance (cleanliness, absence of oxidation, etc.)	■	-	■	■	■
Cleaning of external elements, with a clean dry cloth	■	-	■	■	■
Checking the tightness to torque (covers, wiring ducts, connections, etc.)	■	-	■	■	■
Checking the mechanical controls by carrying out a few operations	■	-	■	■	■
Checking the positioning of the status indicators (open and closed)	■	-	■	■	■
Control of the status and the functioning of the mechanical locking by key locks	■	-	■	■	■
Dusting and cleaning the internal mechanical elements (without solvent)	■	-	-	■	■
Inspection of the tightening of the threaded fasteners and presence of internal stops	■	-	-	■	■
Dusting and cleaning the internal mechanical elements (with solvent)	-	■	-	-	■
Lubrication and greasing of mechanical elements (with recommended products)	-	■	-	-	■
Monitoring the general appearance of the mechanical components and connections	-	■	-	-	■
Testing the "function" mechanical interlocks	-	■	-	-	■

Preventive Maintenance	Frequency		Levels		
Operations that are specific to the “moving part” compartment	3 years	6 years	1	2	3
Ensure the smooth functioning of the shutters (plugging-in/withdrawing)	-	■	-	■	■
Checking the state of the plugging-in electrodes	-	■	-	-	■
Cleaning of the insulating elements, with a clean dry cloth	-	■	-	-	■
Cleaning and lubricating the mechanical parts [see § 15.5]	-	■	-	-	■
Examination of the electrical power contacts	-	■	-	-	■
Checking for the absence of overheating or of discharges in the plugging-in electrodes	-	■	-	-	■
Operations that are specific to the busbar compartment	3 years	6 years	1	2	3
Checking the tightness of the busbar connections	-	■	-	■	■
Checking the leaktightness in the compartment	-	■	-	■	■
Cleaning the internal elements (insulators, connections, supports, etc.)	-	■	-	■	■
Visual inspection of the appearance of the internal components	-	■	-	-	■
Operations that are specific to the “High Voltage cables” compartment	3 years	6 years	1	2	3
Checking the state of the earthing switch contacts	-	■	-	-	■
Checking the leaktightness in the compartment	-	■	-	-	■
Examination of the state of the cable reassemblies	-	■	-	-	■
Cleaning the internal elements (insulators, connections, supports, etc.)	-	■	-	-	■
Cleaning and lubricating the mechanical parts (see § 15.5)	-	■	-	-	■
Visual inspection of the appearance of the internal components	-	■	-	-	■
Operations specific to the Low Voltage box	3 years	6 years	1	2	3
Checking the state of the internal components	-	■	-	■	■
Checking the tightness to torque of the terminals and electrical connections in general	-	■	-	■	■
Examination of the general state of the wiring and the relays	-	■	-	■	■

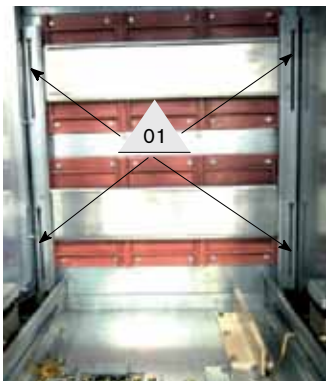
### 15.4 Systematic preventive maintenance

A systematic check of all High Voltage connections tightening points may be requested by the customer. Every 3 operations, it is therefore necessary to replace all of the threaded fasteners.



In certain cases, it would be necessary to grease certain screws (please refer to the assembly drawings).

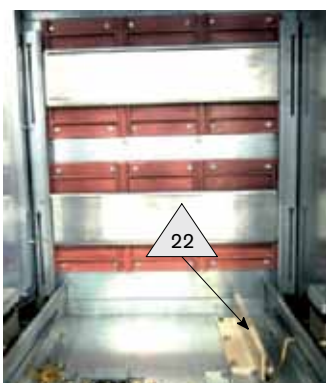




## 15.5 Lubricating and greasing points

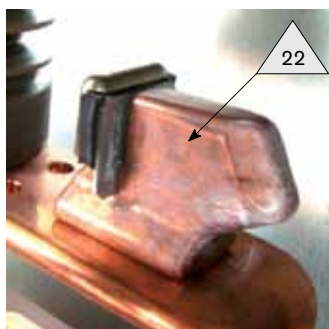
Apply the General Safety Instructions for Electrical Applications and the particular regulations for the network concerned for the locking out procedures.

- Greasing of the sliding joints for guiding the shutters



- Greasing of the earthing shoe (optional) of the moving part.

Greases: see § 2.5



- Greasing of the plugging in contacts of the earthing switch.

Duration: 2 hrs per functional unit

## 15.6 Replacement of a luminous indicator VPIS

	Levels		
Replacement	1	2	3
Replacement of a luminous indicator VPIS	■	■	■

The defective luminous indicator can be replaced on a functional unit whilst energized.

Unscrew the 2 screws on the indicator.

Remove the indicator from its housing.

Disconnect the connector(s).

Connect up a new indicator lamp (no special order or assignment for the connection of the connectors), place it in its housing and screw the 2 screws back in.



## 15.7 Anomalies and remedies

Observation	Mechanism	Probable cause	Remedy
■ Unusual noises when energized, crackling, vibrations.	■ Voltage presence box	■ "Faston" plug poorly	■ Check the connections
	■ Capacitive voltage divider	■ Defective voltage divider	■ Replace the defective capacitive voltage divider
	■ Insulators	■ Polluted or degraded insulating parts	■ Clean the parts or consult our After-Sales Service: see address at the beginning of the manual
■ Abnormal overheating at the connecting points.	■ Connecting	■ Poor tightening	■ Retighten to the appropriate torque after cleaning the contact plates
■ Voltage presence indicator extinguished.	■ MV fuse on outgoing switch or contactor	■ Fuse blown	■ Replace all three fuses
	■ Voltage presence box	■ Deterioration of a component	■ Replace the box
■ Abnormal efforts for mechanical parts operations.	■ Earthing switch	■ Safety interlocking.	■ Check the position of the control mechanisms
	■ Plugging-in of the circuit breaker or contactor moving parts		
■ Circuit breaker does not close.	■ Line section switch or LV circuit breaker	■ Line section switch or LV circuit breaker open	■ Check the closure of the switch or the LV circuit breaker
	■ Protection devices	■ Action by protection devices	■ Check the adjustments
	■ External connections	■ Poor connection	■ Check wiring diagrams
	■ Low voltage connector of the circuit breaker	■ Poor connection	■ Check the connection

# 16 Spare parts

## 16.1 Spare part

Designates an element which is intended to replace an appropriate element in order to restore the required original function.



These parts may only be replaced by a skilled person who has been trained accordingly.

For scheduled replacement	Designation	Replacement every	Levels		
			1	2	3
These are wear parts which have been developed for replacement once a specified utilization period has expired.	Fan (3 each)	30,000 hours energized	■	■	■
Application: maintenance stock, required for optimum execution of maintenance at 6-year intervals.	Undervoltage tripping coil	40,000 hours energized	■	■	■
	HV fuses (3 each)	20 years	■	■	■
	Heating resistor	-	■	■	■

For non-scheduled replacement	Designation	Levels		
		1	2	3
Designates spare parts which are replaced according to specific operating conditions.	Tertiary resistor	■	■	■
Application: Parts which are replaced in case of corrective maintenance outside of the preventive maintenance intervals.	Illuminated display VPIS	■	■	■

For replacement in exceptional cases	Designation	Levels		
		1	2	3
Designates the individual or assembled parts whose anticipated service life is at least as long as that of the switchgear.  Application: Spare parts or modules which are kept for quick replacement.	Busbar bushings	■	■	■
	Insulating cap for nodes	■	■	■
	Micro-contact in racked-in position	■	■	■
	Handle	■	■	■
	Key	■	■	■
	Nylon rivets of arc shutters	■	■	■
	Drawing unit (circuit-breaker, contactor etc.)	■	■	■
	Change-over switch for earthing switch	-	■	■
	Current transformer	-	■	■
	Voltage transformer	-	■	■
	Surge arrester	-	■	■
	Earthing switch drive	-	■	■

## 16 Spare parts (contd.)

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### 16.2 Switchgear identification (see § 5.3)



A list of the technical data of the switchgear must be enclosed with each order of spare parts.

### 16.3 Storage conditions

The parts must be stored so that they are protected against dust, humidity and sun exposure. For convenience they must be identified with the Schneider Electric item number.

Some parts are fragile; preferably they should be kept in their original packaging.

### 16.4 Consumables for maintenance

Designates the products required for maintenance (see § 2.5).

# 17 End of the equipment service life

## 17.1 Valorization of the equipment

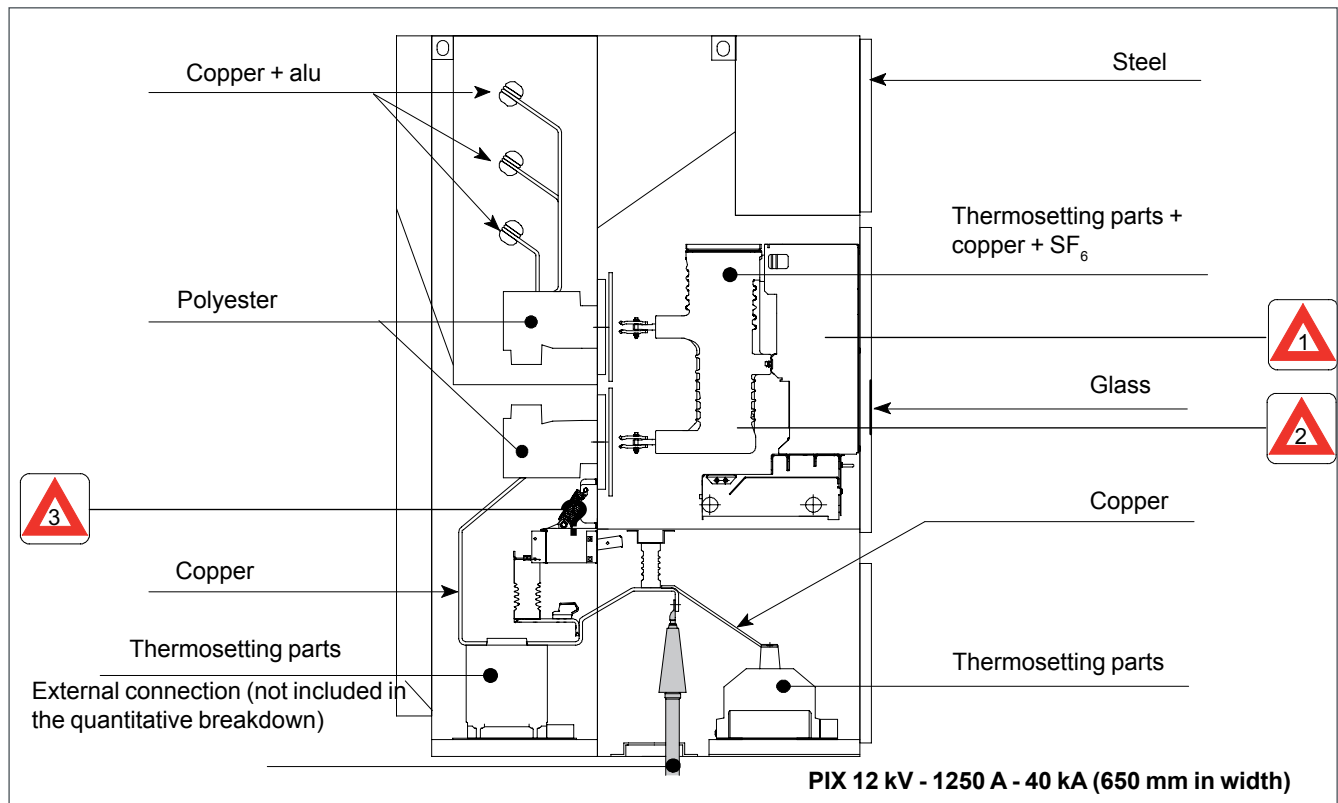
Our functional units are composed of recyclable elements.

The tables (§ 17.4) give information and figures for the types of materials, their quality and their methods of valorization.




They enable the following:

- Calculation to be made of the capacities for valorization,
- Optimising the valorization process,
- Evaluating the cost of valorization.

The indications given in tables (§ 17.3) facilitate co-operation between users and companies specialised in elimination to valorize the product at the end of the product's service life.



## 17.2 Safety instructions

-  Do not dismantle the mechanical control mechanism springs without the releasing device.
-  Do not open the poles without first having recovered the SF<sub>6</sub> gas using the appropriate tools.
-  Do not dismantle the earthing switch's springs without the releasing device.

## 17.3 Disassembly of the switchgear units

Regarding decommissioning, please consult Schneider Electric

- All electrical equipment (coils, drives etc.) must be removed.
- During disassembly, the materials must be sorted and routed to the appropriate recycling procedures.

# 17 End of the equipment service life (contd.)

## 17.4 Specific provisions concerning the circuit-breaker



Collect the SF<sub>6</sub> gas using a collecting unit.

- Dismantle the shut-off poles in a specific room using the specific tool and applying the mandatory precautions.
- Clean the parts before disposal.
- On disassembly, the materials must be sorted and routed to the material-specific recycling facilities.

## 17.5 Dividing up and recycling of the materials used for PIX (see § 17.1)

Total weight: switchgear panel + circuit-breaker + MiCOM relay = 810 Kg

Materials including inserts	Weight (kg)	% of Materials	Recycling
Steel	568,23		Yes (100%)
Stainless steel (Fr.: IPOX?)	3		
Copper and copper-based alloys	105,4		Yes (95%)
Aluminium and aluminium alloys	2,34		
Other non-ferrous metals	0		
<b>Total metal content (whereof inserts)</b>	<b>678,97</b>	<b>83,83</b>	

Material	Weight (kg)	% of Materials	Recycling
Epoxy resin* (except transformers)	39,3		Not recyclable (routed to technical disposal plants)
Epoxy resin in transformers	3		
PUR resin in transformers	51		
Glass fibre reinforced polyester	16,7		
Others	0		
<b>Total thermoset content</b>	<b>110</b>	<b>13,58</b>	

Material	Weight (kg)	% of Materials	Recycling
PC	2,45		Not recyclable
PTFE	0,08		
PVC	0		
PBT	10,6		
PA	1,92		
Others (PMMA, PE, PET)	0,13		
<b>Total thermoset content</b>	<b>15,18</b>	<b>1,88</b>	

Material	Weight (kg)	% of Materials	Recycling
Elastomers	0,16	0,02	Not recyclable
Paint	0,2	0,02	
Glass	4,14	0,51	

Material	Weight (kg)	% of Materials	Recycling
SF <sub>6</sub>	0,55	0,07	Yes (100%) (Recycling by regeneration)

Other materials	Weight (kg)	% of Materials	Recycling
Total others	0,8	0,09	Not recyclable





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